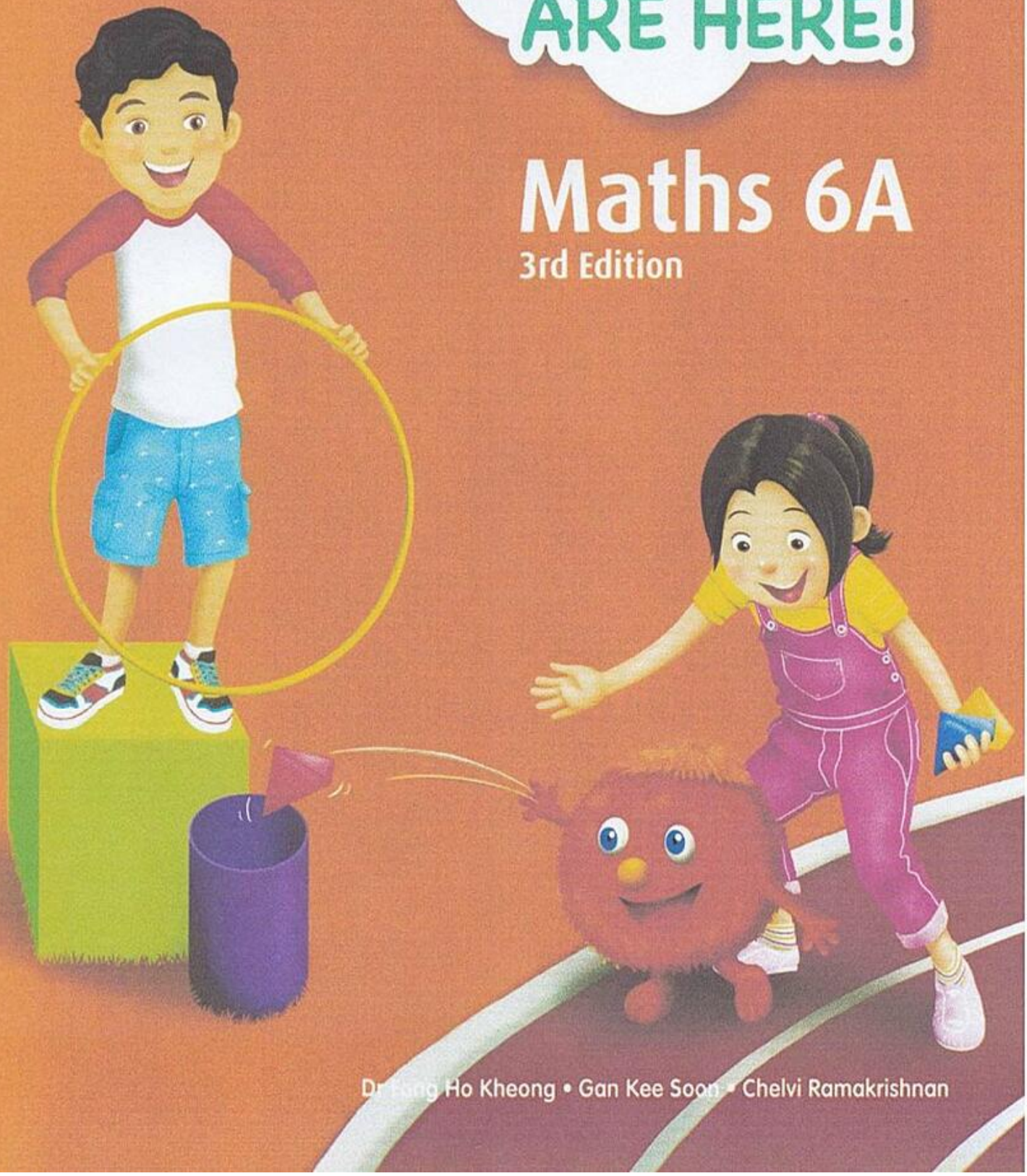
Marshall Cavendish Education

Pupil's Book

MY PALS ARE HERE!

Maths 6A

3rd Edition



Dr Fong Ho Kheong • Gan Kee Soon • Chelvi Ramakrishnan

Pupil's Book

MY PALS ARE HERE!

Maths 6A

3rd Edition

Dr Fong Ho Kheong • Gan Kee Soon • Chelvi Ramakrishnan

Marshall Cavendish Education

Preface

My Pals Are Here! Maths (3rd Edition) is a comprehensive, task-based and learner-centred programme designed to provide pupils with a solid foundation in mathematics and opportunities to become efficient problem solvers.

My Pals Are Here! Maths (3rd Edition) continues to make learning mathematics fun and rewarding through the use of engaging illustrations, photographs, hands-on activities and interactives that help reinforce and consolidate learning for pupils of different abilities.

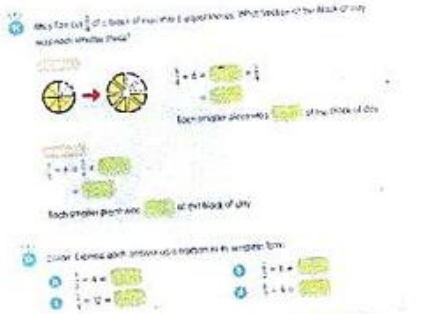
A calculator may be used when appears.

For the Pupil:

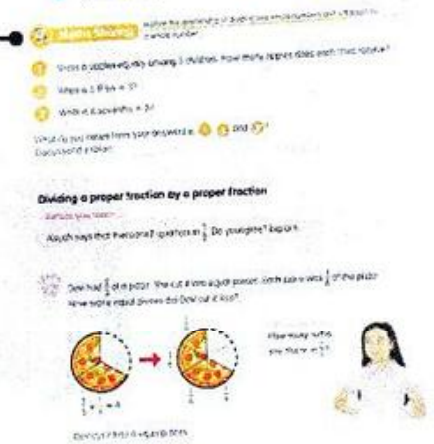
Challenge yourself to solve non-routine questions by applying relevant heuristics and thinking skills in Put On Your Thinking Cap!

NEW!

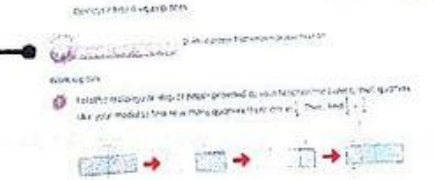
Practise new concepts learnt in parallel questions with help from your teacher in TRY!



Share your thoughts with your teachers, create your own mathematics questions and become aware of your own mathematical thinking in Maths Sharing!

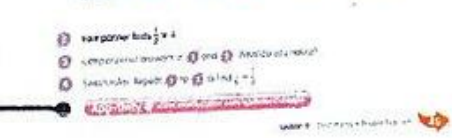


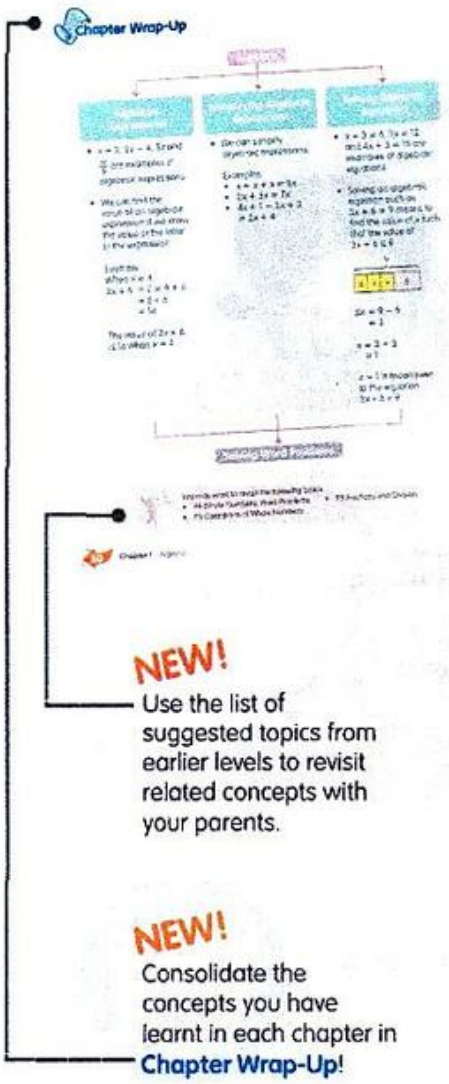
Become active learners and collaborate with your classmates in Hands-On Activity!



NEW!

Master the concept you have learnt through engaging and interactive applets in App-tivity!





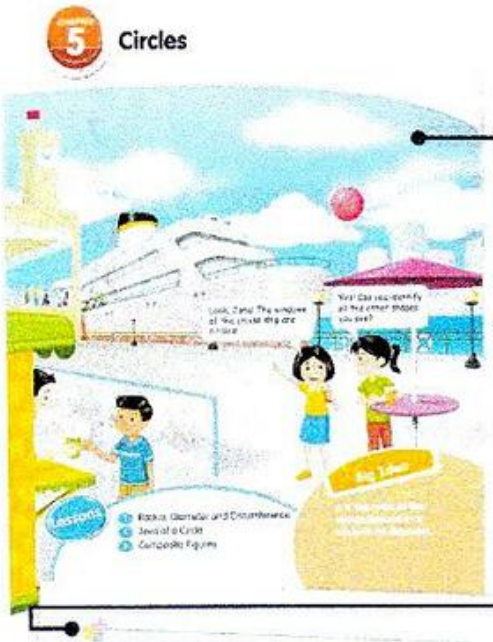
NEW!

Use the list of suggested topics from earlier levels to revisit related concepts with your parents.

NEW!

Consolidate the concepts you have learnt in each chapter in **Chapter Wrap-Up!**

For the Teacher:

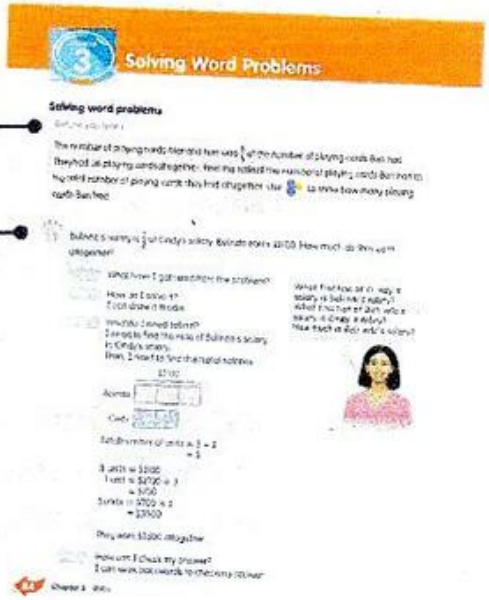


NEW!

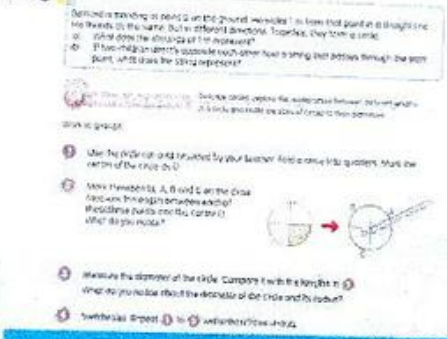
Use scenarios pupils can relate to in the chapter openers to capture their interest, provide an engaging introduction to the topics and jump-start learning.

NEW!

Introduce concepts through context-based tasks in Before you learn. At the end of each task, a question is posed to develop pupils' creative and critical thinking skills.



Teach concepts in concise steps using real-life contexts, manipulatives and meaningful visuals in LEARN.

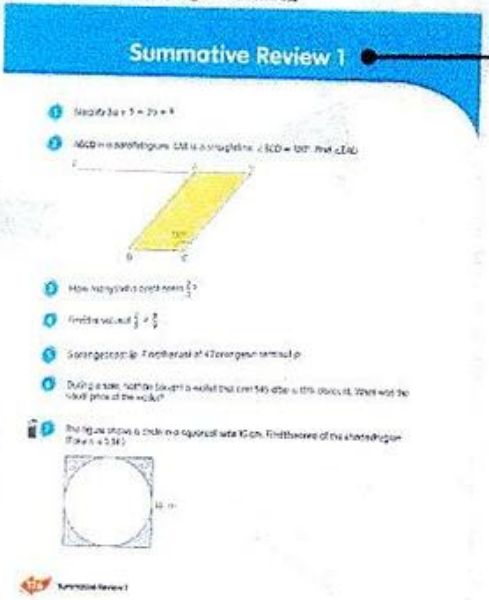


NEW!

Use suggested questions to facilitate classroom discussions that promote mathematical reasoning.

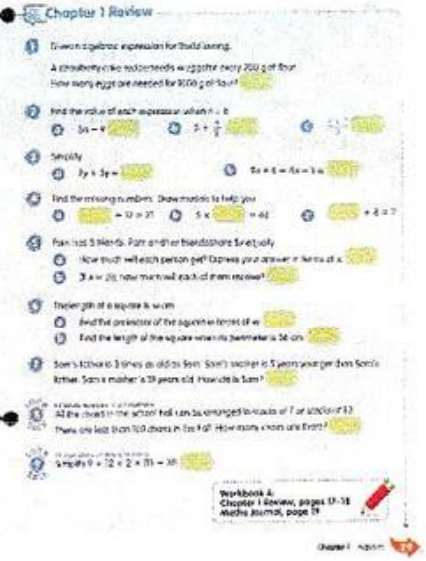
NEW!

Assess understanding when pupils apply concepts learnt in Review.



NEW!

Summative Review provides more practice to do a cumulative consolidation of concepts learnt.



NEW!

Understanding of related concepts from earlier levels is also assessed with LOOK BACK questions.

CONTENTS

1 Algebra 6

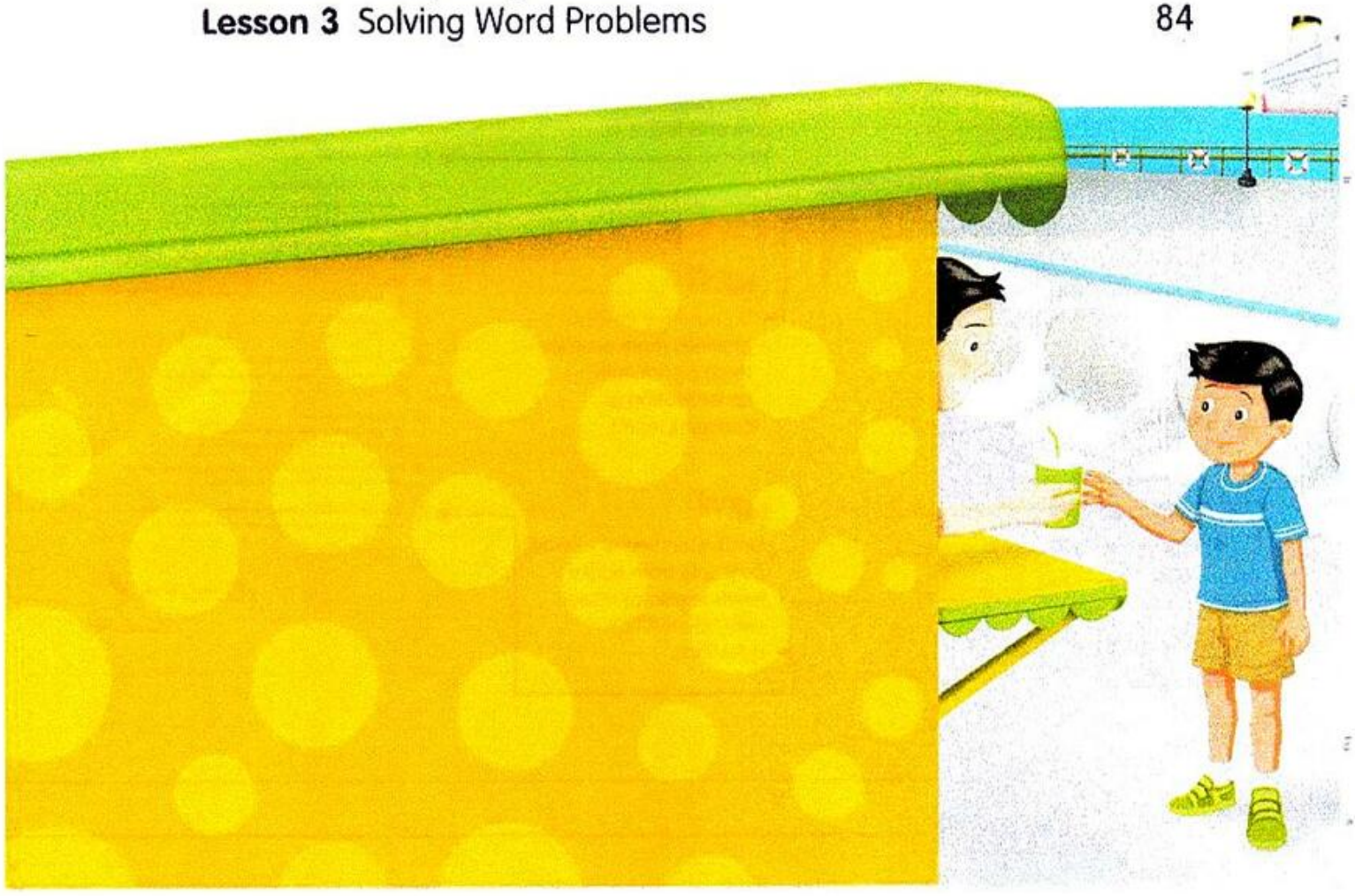
Lesson 1 Using Letters to Represent Numbers 7
Lesson 2 Evaluating Algebraic Expressions 15
Lesson 3 Simplifying Algebraic Expressions 17
Lesson 4 Solving Word Problems 21

2 Fractions 32

Lesson 1 Dividing a Fraction by a Whole Number 33
Lesson 2 Dividing by a Proper Fraction 39
Lesson 3 Solving Word Problems 49

3 Ratio 68

Lesson 1 Ratio and Fraction 69
Lesson 2 Comparing Ratios 77
Lesson 3 Solving Word Problems 84



4 Percentage 106
Lesson 1 Finding Percentages 107
Lesson 2 Percentage Change 110
Lesson 3 Solving Word Problems 122

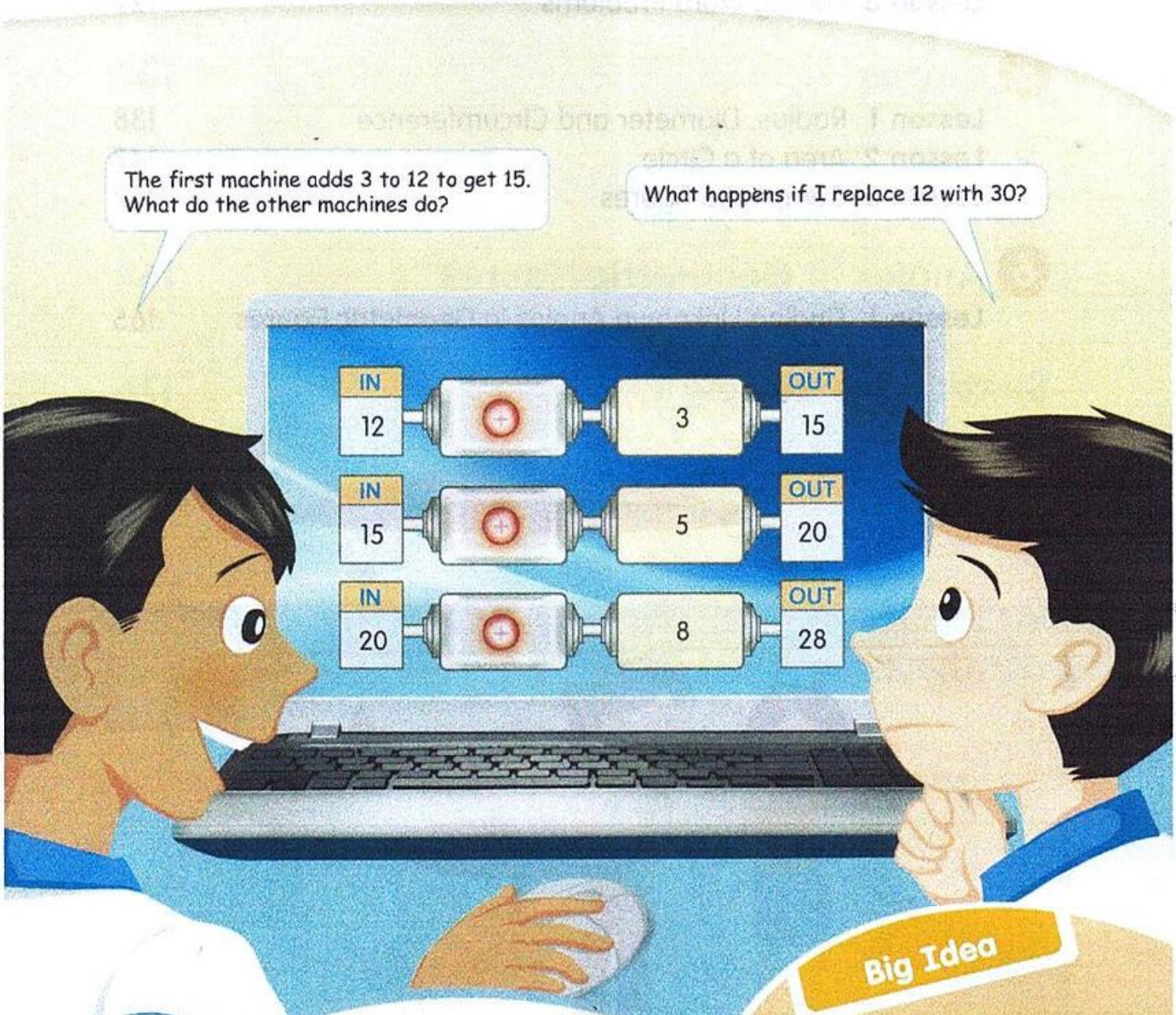
5 Circles 137
Lesson 1 Radius, Diameter and Circumference 138
Lesson 2 Area of a Circle 147
Lesson 3 Composite Figures 152

6 Angles in Geometric Figures 164
Lesson 1 Finding Unknown Angles in Geometric Figures 165

Summative Review 1 176

CHAPTER 1

Algebra



Lessons

1. Using Letters to Represent Numbers
2. Evaluating Algebraic Expressions
3. Simplifying Algebraic Expressions
4. Solving Word Problems

Big Idea

In algebra, a letter is used to represent an unknown number.

Lesson 1

Using Letters to Represent Numbers

Using Letters to Represent Numbers

Before you learn ...

Ryan has some pencils. Ben has 5 more pencils than Ryan. Use the letter x to represent the number of pencils Ryan has. Write an expression in terms of x for the number of pencils Ben has.

LEARN

Rani has 3 sweets.

She gets 1 more sweet. How many sweets does she have now?

$3 + 1 = 4$

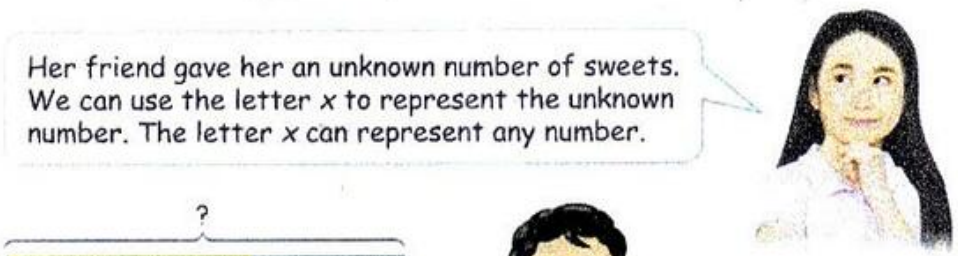
Rani has 4 sweets now.

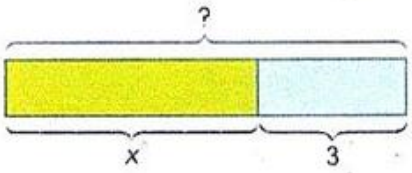
She gets 4 more sweets. How many sweets does she have now?

$3 + 4 = 7$

Rani has 7 sweets now.

Her friend gives her some sweets. How many sweets does she have now?


Her friend gave her an unknown number of sweets. We can use the letter x to represent the unknown number. The letter x can represent any number.



Rani has $(x + 3)$ sweets now.

$x + 3$ is an example of an **algebraic expression** in terms of x.

LEARN 1B

(a) Add 0 to 6

$6 + 0 = 6$

(b) Add 0 to x

$x + 0 = x$

$6 + 0 = 0 + 6 = 6$
$x + 0 = 0 + x = x$

(c) Sum of 11 and 3

$11 + 3 = 14$

(d) Sum of n and 3

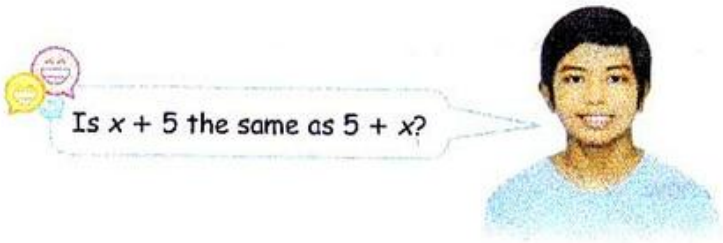
$n + 3$

(e) 4 more than 8

$8 + 4 = 12$

(f) 4 more than y

$y + 4$



TRY 1A

Mr Tan is the form teacher of Primary 6B. The pupils do not know his age.

Let Mr Tan be x years old now. Find Mr Tan's age in terms of x.

Description	Mr Tan's Age (Years)
Mr Tan's age now	x
Mr Tan's age 3 years from now	
Mr Tan's age 5 years from now	
Mr Tan's age 10 years from now	

TRY 1B

Give an algebraic expression for each of the following.

(a) Add 5 to x

(b) Sum of z and 8

(c) 3 more than p

LEARN

Aiden has 20 cookies.

(a) Tom has 5 cookies. How many more cookies does Aiden have than Tom?

$20 - 5 = 15$

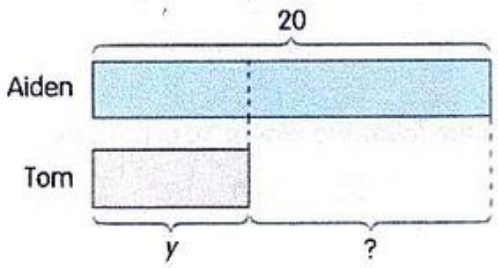
Aiden has 15 more cookies than Tom.

(b) Tom has 12 cookies. How many more cookies does Aiden have than Tom?

$20 - 12 = 8$

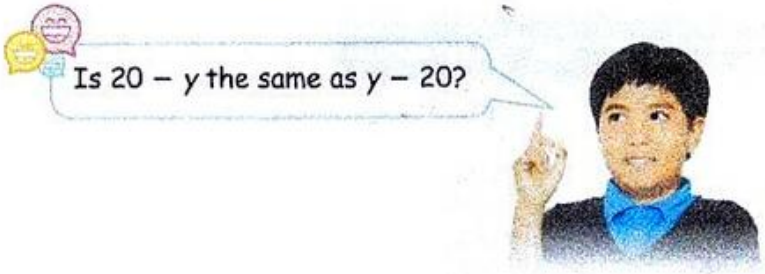
Aiden has 8 more cookies than Tom.

(c) Tom has y cookies. How many more cookies does Aiden have than Tom?



Aiden has $(20 - y)$ more cookies than Tom.

$20 - y$ is another example of an algebraic expression.



LEARN

(a) Subtract 3 from 7

$7 - 3 = 4$

(b) 1 less than 12

$12 - 1 = 11$

(c) Subtract 3 from a

$a - 3$

(d) 1 less than x

$x - 1$

LEARN

Hands-On Activity

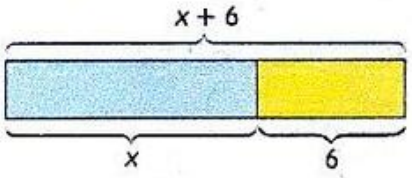
Draw models to represent algebraic expressions.

Work in pairs.

1. Describe the algebraic expression $x + 6$ in as many ways as you can.

   Example
   Add 6 to x
   The sum of 6 and x

2. Your partner draws a model for the algebraic expression in 1.



3. Switch roles. Repeat 1 and 2 with the following algebraic expressions.

   a. $2 + w$ b. $p + 3$ c. $7 - n$ d. $n - 7$

TRY 2A

Mrs Lee is a new teacher in Serai Primary School. The pupils do not know her age.

Let Mrs Lee be k years old now. Find Mrs Lee's age in terms of k.

Description	Mrs Lee's Age (Years)
Mrs Lee's age now	k
Mrs Lee's age 1 year ago	
Mrs Lee's age 2 years ago	
Mrs Lee's age 15 years ago	

TRY 2B

Give an algebraic expression for each of the following.

a. Subtract 7 from z
b. Subtract b from 8
c. 10 less than h
d. w less than 20

LEARN

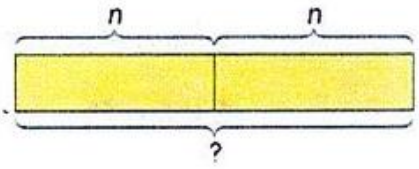
Andrew has 2 empty boxes.

(a) He puts 12 books into each box. How many books are there altogether?

$2 \times 12 = 24$

There are 24 books altogether.

(b) He puts n books in each box. How many books are there altogether?



$2 \times n = 2n$

There are $2n$ books altogether.

Gopal has n baskets.

(a) He puts 2 eggs in each basket. How many eggs are there altogether?

$n \times 2 = 2n$

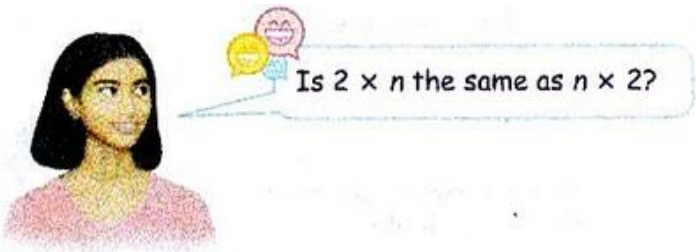
There are $2n$ eggs altogether.

(b) He puts 1 egg in each basket. How many eggs are there altogether?

$n \times 1 = n$

There are n eggs altogether.

$2n$ and n are also examples of algebraic expressions.



LEARN 3A

(a) (i) Multiply 1 by 4

$1 \times 4 = 4$

(ii) Multiply 1 by y

$1 \times y = y$

$1 \times 4 = 4 \times 1 = 4$
$1 \times y = y \times 1 = y$

(b) (i) 6 groups of 10

$6 \times 10 = 60$

(ii) 6 groups of k

$6 \times k = 6k$

(c) (i) Product of 5 and 7

$5 \times 7 = 35$

(ii) Product of 5 and h

$5 \times h = 5h$

TRY 3A

There are n stickers in a pack. Find the number of stickers in terms of n.

Number of Packs	1	3	6	10	15
Number of Stickers	n				

TRY 3B

Give an algebraic expression for each of the following.

(a) 4 groups of b

(b) Multiply h by 6

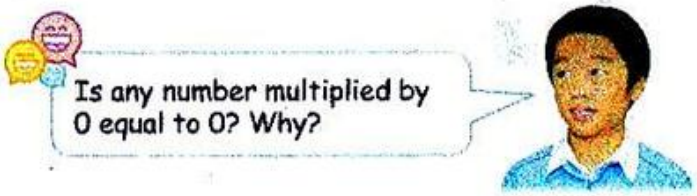
(c) Product of 8 and g

TRY 3C

Give an algebraic expression for each of the following.

(a) $3 \times 0 =$ ____ $\times 3 =$ ____

(b) $a \times 0 = 0 \times$ ____ $=$ ____



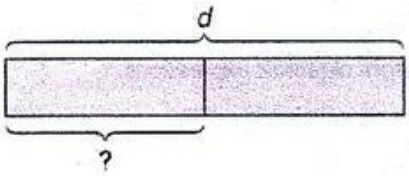
LEARN

16 g of raisins were shared equally between 2 children. How many grams of raisins did each child receive?

$16 \div 2 = 8$

Each child received 8 g of raisins.

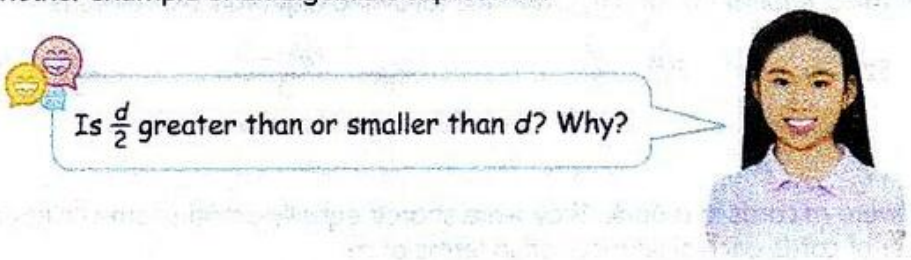
There were d g of raisins in a box. The raisins were shared equally between 2 children. How many grams of raisins did each child receive?



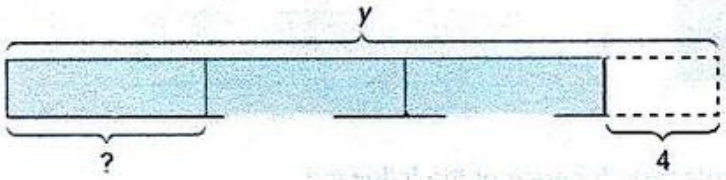
$d \div 2 = \frac{d}{2}$

Each child received $\frac{d}{2}$ g of raisins.

$\frac{d}{2}$ is another example of an algebraic expression.



Mrs Ng baked y tarts at first. She ate 4 tarts. The remaining tarts were shared equally among her 3 children. How many tarts did each child receive?



$(y - 4) \div 3 = \frac{(y - 4)}{3}$

Each child received $\frac{(y - 4)}{3}$ tarts.

$\frac{d}{2}$ and $\frac{(y - 4)}{3}$ are also examples of algebraic expressions.

LEARN

(a) (i) Divide 18 by 9.

$18 \div 9 = 2$

(ii) Divide n by 9.

$n \div 9 = \frac{n}{9}$

(b) Give an algebraic expression for the following.

Add 5 to the product of 7 and n.

$7 \times n + 5 = 7n + 5$

LEARN

Hands-On Activity Draw models to represent algebraic expressions.

Work in pairs.

1. Describe the algebraic expression $3w$ in as many ways as you can.
2. Your partner draws a model for the algebraic expression in 1.
3. Switch roles. Repeat 1 and 2 with the following algebraic expressions.

(a) $5z$ (b) $\frac{g}{4}$ (c) $\frac{120 - n}{3}$ (d) $\frac{k + 25}{2}$

TRY 4A

There were m cards in a pack. They were shared equally among some children. Find the number of cards each child received in terms of m.

Number of Children	1	4	6	8	12
Number of Cards Each Child Received	m				

TRY 4B

Give an algebraic expression for each of the following.

(a) Divide n by 7.

(b) Divide the sum of r and 11 by 4.

Workbook A: Practice 1, pages 5–6

Lesson 2

Evaluating Algebraic Expressions

Finding the value of an algebraic expression

Before you learn ...

A box contains y muffins. Kevin eats 2 muffins. Write an expression in terms of y for the number of muffins left. Explain how you would find the number of muffins left in the box when $y = 12$.

LEARN

a Find the value of $x + 5$ when $x = 9$.

When $x = 9$,
$x + 5 = 9 + 5$
$= 14$

To find the value of an algebraic expression, we replace the letter with the given number.

b Find the value of $30 - y$ when $y = 6$.

When $y = 6$,
$30 - y = 30 - 6$
$= 24$

c Find the value of $8p$ when $p = 7$.

When $p = 7$,
$8p = 8 \times p$
$= 8 \times 7$
$= 56$

d Find the value of $\frac{q}{10}$ when $q = 60$.

When $q = 60$,
$\frac{q}{10} = \frac{60}{10}$
$= 6$

e Find the value of $\frac{m}{4} - 9$ when $m = 36$.

When $m = 36$,
$\frac{m}{4} - 9 = \frac{36}{4} - 9$
$= 9 - 9$
$= 0$

TRY 1A Find each missing value.

Expression	Value of Expression When $z = 8$	Value of Expression When $z = 16$
$12 + z$		
$25 - z$		
$3z - 14$		
$\frac{z}{16} + 15$		

TRY 1B Find the value of each expression when $q = 20$.

a $\frac{4 + 2q}{11}$

b $\frac{125 - q}{7}$

c $\frac{11q}{4} + 25$

d $\frac{14q + 80}{30}$

TRY 1C There are n apples in a box. Give an expression in terms of n for each of the following and find the value when $n = 24$.

a The number of apples left after 6 apples have been eaten

b The number of apples each child gets when a box of apples is shared equally among 4 children

c The number of apples each child gets when one box and 11 apples are shared equally among 5 children

TRY 1D John is x years old now. Give an expression in terms of x for each of the following and find the value when $x = 18$.

a The age of his brother, who is 5 years older

b The age of his aunt, who is twice as old

c The age of his cousin, who is half his age

Workbook A: Practice 2, pages 7–8

Lesson 3

Simplifying Algebraic Expressions

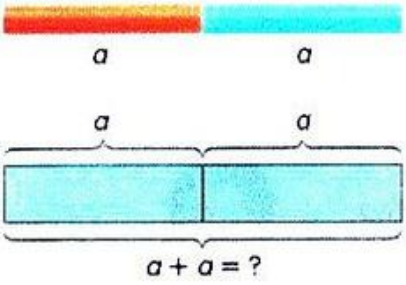
Simplifying algebraic expressions

Before you learn ...

A plumber joins a pipe of length s m to another pipe twice its length. What is the total length of the two pipes? Explain.

LEARN

A rod of length a m is joined to another rod also a m long.
What is the total length of the two rods?



Total length of the two rods = $(a + a)$ m

We can **simplify** $(a + a)$ as $2a$.

The total length of the two rods is $2a$ m.

3	3

$3 + 3 = 2 \times 3$

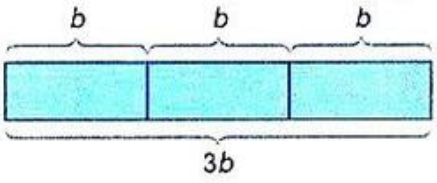
4	4

$4 + 4 = 2 \times 4$

a	a

$a + a = 2 \times a$
$= 2a$

Ainu, Banu and Claire have $\$b$ each. Find the total amount of money they have.



Total amount of money = $\$(b + b + b)$

We can simplify $(b + b + b)$ as $3b$.

The total amount of money they have is $\$3b$.

5	5	5

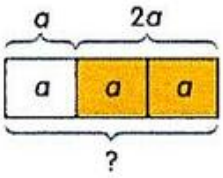
$5 + 5 + 5 = 3 \times 5$

b	b	b

$b + b + b = 3 \times b$
$= 3b$

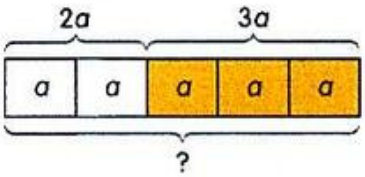
LEARN 1B

a Simplify $a + 2a$.

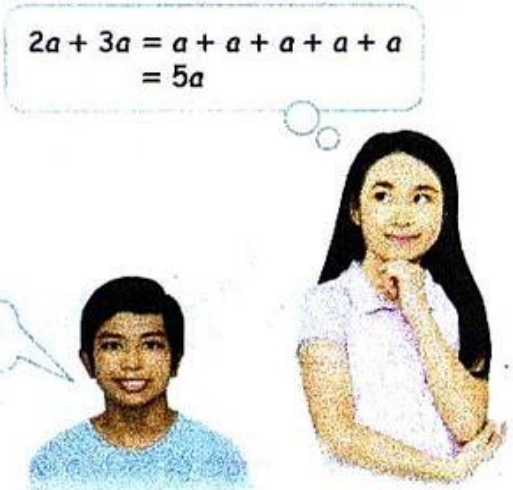


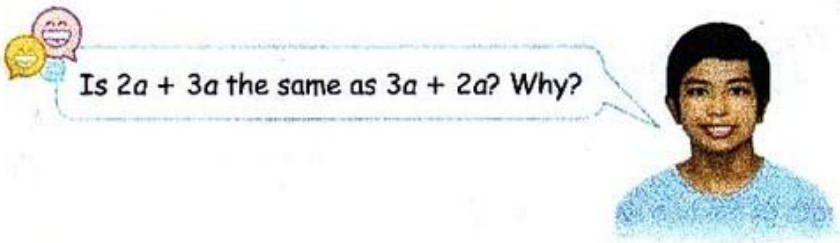
$a + 2a = 3a$

b Simplify $2a + 3a$.



$2a + 3a = 5a$





TRY 1A

Simplify.

a $x + x =$ ____

b $y + y + y =$ ____

c $a + a + a + a + a =$ ____

d $b + b + b + b + b + b =$ ____

e $c + c + c + c + c + c + c =$ ____

TRY 1B

Simplify.

a $a + 3a =$ ____

b $2z + 5z =$ ____

c $4x + x =$ ____

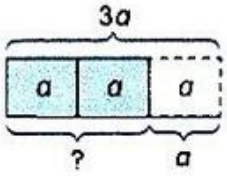
d $3y + 6y =$ ____

e $b + 2b + 3b =$ ____

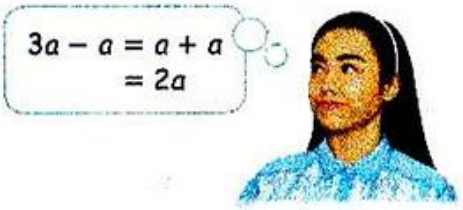
f $4c + 2c + 5c =$ ____

LEARN 2

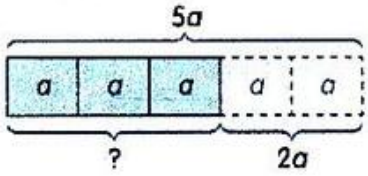
a Simplify $3a - a$.



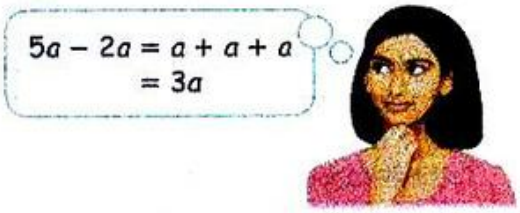
$3a - a = 2a$



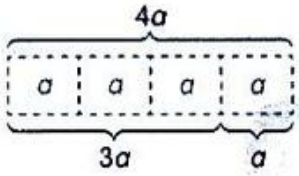
b Simplify $5a - 2a$.



$5a - 2a = 3a$



c Simplify $4a - 3a - a$.



$4a - 3a - a = a - a$
$= 0$

TRY 2

Simplify.

a $4a - a =$ ____

b $7a - 3a =$ ____

c $5x - x =$ ____

d $10x - 6x =$ ____

e $8y - 3y - 5y =$ ____

f $12y - 7y - y =$ ____

LEARN

Simplify $6a + 3a - 2a$.

$6a + 3a - 2a = 9a - 2a$
$= 7a$

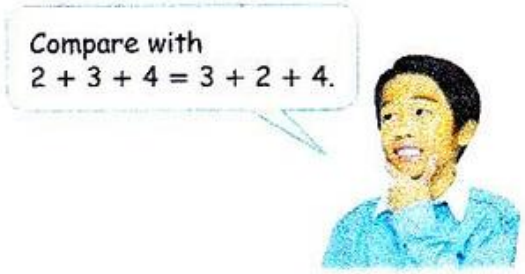
Simplify $6a - 2a + 3a$.

$6a - 2a + 3a = 4a + 3a$
$= 7a$

LEARN

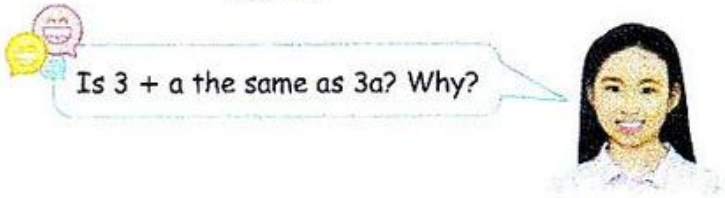
Find the distance from Point A to Point B.

Total distance $= a + 4 + a + 3$
$= a + a + 4 + 3$
$= (2a + 7)$ km



Simplify $4x + 6 - 3x$.

$4x + 6 - 3x = 4x - 3x + 6$
$= x + 6$



TRY 3A

Simplify.

(a) $2x + 3x - 4x =$ ____

(b) $x + 5x - 6x =$ ____

(c) $9a - 3a + 4a =$ ____

(d) $12a - 7a + 2a =$ ____

TRY 3B

Simplify.

(a) $b + 6 + b + 5 =$ ____

(b) $3b + 4b + 2 + 6 =$ ____

(c) $5s + 9 - 3s =$ ____

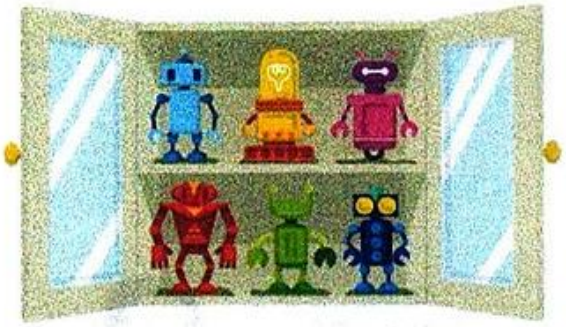
(d) $8s + 6 - 2s - 1 =$ ____

Workbook A: Practice 3, pages 9–10

Lesson 4 Solving Word Problems

Recall

1. $5 + 4 = 9$
   $4 + 5 = 9$
   $9 - 5 = 4$
   $9 - 4 = 5$

2. 

How many robots are there?

$2 \times 3 = 6$ or $3 \times 2 = 6$

How many shelves are there?

$6 \div 3 = 2$

How many robots are there on each shelf?

$6 \div 2 = 3$

3 Find the missing numbers.

(a) ▭ + 7 = 13

▭ = 6

(b) 14 + ▭ = 19

▭ = 5

(c) ▭ − 8 = 9

▭ = 17

(d) 18 − ▭ = 6

▭ = 12

(e) 4 × ▭ = 24

▭ = 6

4 × 6 = 24
24 ÷ 4 = 6

(f) ▭ ÷ 7 = 8

▭ = 56

56 ÷ 7 = 8
8 × 7 = 56

Solving word problems

Before you learn ...

Rani and Suzy baked 54 muffins altogether. Rani baked twice as many muffins as Suzy. How many muffins did Rani bake? Draw a model to form an equation. Then, solve the equation.

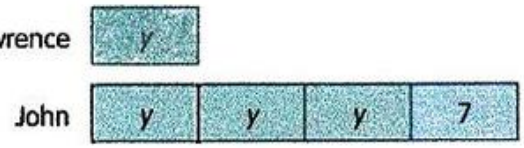
LEARN

Lawrence has y books. John has 3 times as many books as Lawrence. John buys another 7 books.

(a) How many more books does John have than Lawrence? Give your answer in terms of y in the simplest form.

(b) If Lawrence has 25 books, how many more books does John have than Lawrence?

(a)

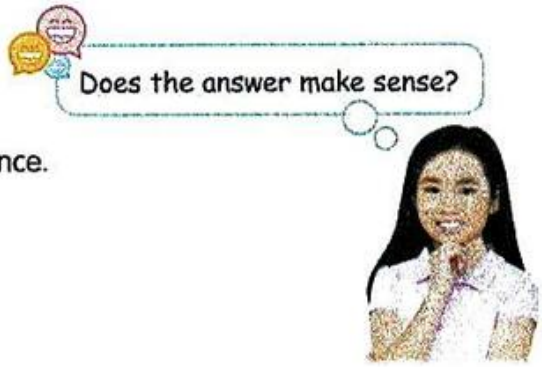


John has $(3y + 7)$ books.

$3y + 7 - y = 2y + 7$

John has $(2y + 7)$ more books than Lawrence.

(b) $2y + 7 = (2 \times 25) + 7$
$= 50 + 7$
$= 57$



John has 57 more books than Lawrence.

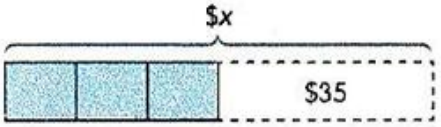
LEARN

Charlene had $x. She bought a dress for $35 and spent the rest of her money on 3 identical notebooks.

(1) Find the price of 1 notebook in terms of x.

(2) If Charlene had $50, what was the price of 1 notebook?

(1)



Price of 3 notebooks = $\$(x - 35)$

$\$(x - 35) \div 3 = \$\left(\frac{x - 35}{3}\right)$

The price of 1 notebook is $\$\left(\frac{x - 35}{3}\right)$.

(2) $\$\left(\frac{x - 35}{3}\right) = \$\left(\frac{50 - 35}{3}\right)$

$= \$\left(\frac{15}{3}\right)$

$= \$5$

The price of 1 notebook was $5.

TRY 1A

Some adults and children are watching a musical. There are n children. There are 25 fewer adults than children.

(a) Find the number of adults in terms of n.

(b) If there are 124 children, how many adults are there?

TRY 1B

Yahya has $\$m$ and Bala has \$25 more.

(a) Find the amount of money they have altogether in terms of m.

(b) If $m = 35$, how much money do they have altogether?

TRY 1C

Mr Chong had $\$y$ in his wallet at first. After withdrawing \$300 from the bank, he gave his wife half of the total amount of money he had.

(a) Find the amount of money he had left in terms of y.

(b) If Mr Chong had \$60 in his wallet at first, how much money did he have left?

TRY 1D

Ribbon A is k m long. Ribbon B is twice as long as Ribbon A. Ribbon C is 1 m shorter than Ribbon B.

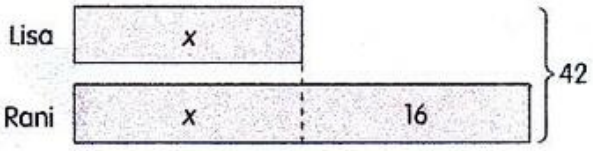
(a) Find the length of Ribbon C in terms of k.

(b) If $k = 3$, how long is Ribbon C?

LEARN 2

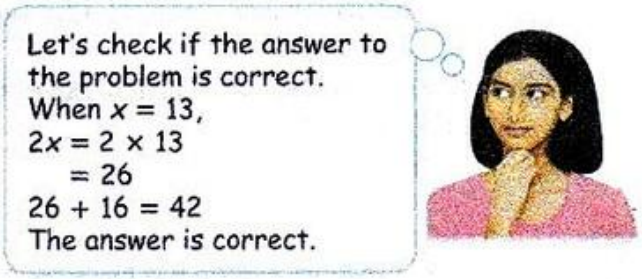
a Rina and Lisa baked 42 muffins altogether. Rani baked 16 more muffins than Lisa. How many muffins did Lisa bake?

Let x be the number of muffins Lisa baked.



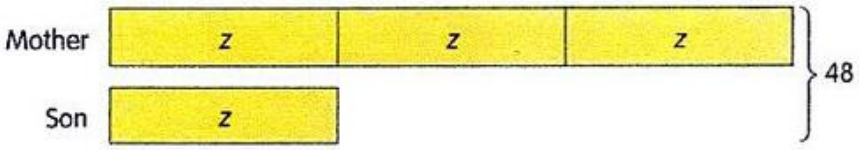
$2x = 42 - 16$
$= 26$
$x = 26 \div 2$
$= 13$

Lisa baked 13 muffins.



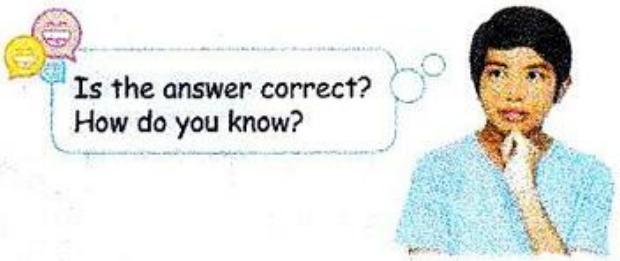
b A mother is now 3 times as old as her son. If the sum of their ages is 48 years, how old is the son?

Let the son be z years old now.



$4z = 48$
$z = 48 \div 4$
$= 12$

The son is 12 years old.



LEARN

Hands-on Activity

Form and solve simple equations in word problems.

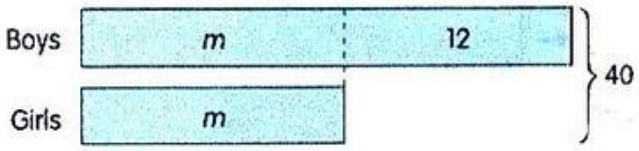
Work in pairs.

1. Draw a model for the following word problem.

> 40 pupils went to the zoo. There were 12 more boys than girls. How many girls were there?

2. Your partner uses the model in 1 to form an equation and solve it.

Example
Let m be the number of girls.



$2m = 40 - 12$
$= 28$
$m = 28 \div 2$
$= 14$

There were 14 girls.

3. Check that your partner's answer is correct.

Example
When $m = 14$,

$m + 12 + m = 14 + 12 + 14$
$= 26 + 14$
$= 40$

My partner's answer is correct.

4. Switch roles. Repeat steps 1 to 3 for the following.

   a. The sum of the ages of Chloe and Jun Jie is 27 years. If Chloe is 5 years younger than Jun Jie, what are their ages?

   b. John and Raju share $45. Raju's share is twice of John's share. How much does each of them get?

   c. Roy thinks of a number. When he multiplies it by 5 and adds 15 to the result, he gets 70. What number is Roy thinking of?

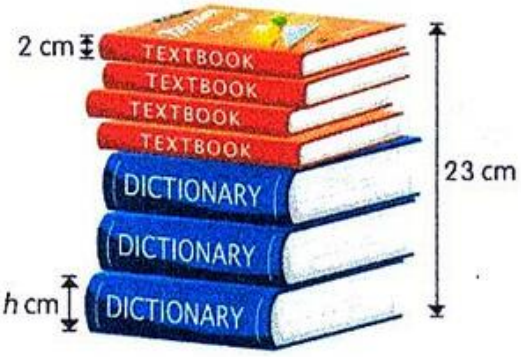
TRY 2

Draw a model for each word problem. Use the model to form an equation. Then, solve the equation.

(a) Raju and Ryan scored a total of 96 points in a computer game. Ryan scored 18 fewer points than Raju. How many points did Raju score?

(b) Paul thinks of a number. When he multiplies the number by 3 and subtracts 15 from the result, he gets 9. What number is Paul thinking of?

(c) A textbook was 2 cm thick and a dictionary was h cm thick. Jamal stacked 3 such dictionaries and 4 such textbooks. The stack of books was 23 cm tall. How thick was each dictionary?



(d) Munah thinks of a number. When she divides the number by 8 and adds 6 to the result, she gets 45. What number is Munah thinking of?

(e) Rehna had a piece of wire, d cm long. She cut off 8 cm of it and bent the remaining wire into an equilateral triangle. Each side of the equilateral triangle measured 9 cm. How long was the piece of wire?

Maths Sharing

Write word problems.

Write a word problem for each equation such that it has the same answer as that of the equation.

(a) $n - 8 = 24$

(b) $2n + 6 = 18$

(c) $\frac{n}{5} - 8 = 2$

Then, exchange the word problems with your classmates and ask them to solve it.

Workbook A: Practice 4, pages 11–16

Chapter 1 Review

1 Give an algebraic expression for the following.

A strawberry cake recipe needs w eggs for every 200 g of flour.
How many eggs are needed for 1000 g of flour?

2 Find the value of each expression when $n = 8$.

a $3n - 9$ **b** $5 + \frac{n}{2}$ **c** $\frac{n+7}{3}$

3 Simplify.

a $7y + 3y =$ **b** $9x + 6 - 8x - 1 =$

4 Find the missing numbers.

a $\square + 12 = 18$ **b** $5 \times \square = 40$ **c** $\square \div 8 = 7$

5 Pam and 3 friends share $\$x$ equally.

a How much will each person get? Express your answer in terms of x.

b If $x = 28$, how much will each of them receive?

6 The length of a square is w cm.

a Find the perimeter of the square in terms of w.

b Find the length of the square when its perimeter is 36 cm.

7 Sam's father is 3 times as old as Sam. Sam's mother is 5 years younger than Sam's father. Sam's mother is 31 years old. How old is Sam?

LOOK BACK 8 P4 Whole Numbers: Word Problems
All the chairs in the school hall can be arranged in stacks of 7 or stacks of 9. There are fewer than 100 chairs in the hall. How many chairs are there?

LOOK BACK 9 P5 Operations of Whole Numbers
Simplify $9 + 12 \div 2 \times (15 - 10)$.

Workbook A:
Chapter 1 Review, pages 17–18
Maths Journal, page 19

Chapter Wrap-Up

Algebra

Algebraic Expressions

- $x + 2$, $2y - 4$, $3z$ and $\frac{w}{5}$ are examples of algebraic expressions.
- We can find the value of an algebraic expression if we know the value of the letter in the expression.

  Example:
  When $x = 4$,
  $2x + 6 = 2 \times 4 + 6$
  $= 8 + 6$
  $= 14$

  The value of $2x + 6$ is 14 when $x = 4$.

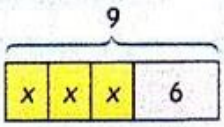
Simplifying Algebraic Expressions

- We can simplify algebraic expressions.

  Examples:
  - $x + x + x = 3x$
  - $2x + 5x = 7x$
  - $4x + 1 - 2x + 3 = 2x + 4$

Solving Algebraic Equations

- $x + 3 = 6$, $3x = 12$ and $4x + 3 = 15$ are examples of algebraic equations.
- Solving an algebraic equation such as $3x + 6 = 9$ means to find the value of x such that the value of $3x + 6$ is 9.



$3x = 9 - 6$
$= 3$

$x = 3 \div 3$
$= 1$

$x = 1$ is the answer to the equation $3x + 6 = 9$.

Solving Word Problems

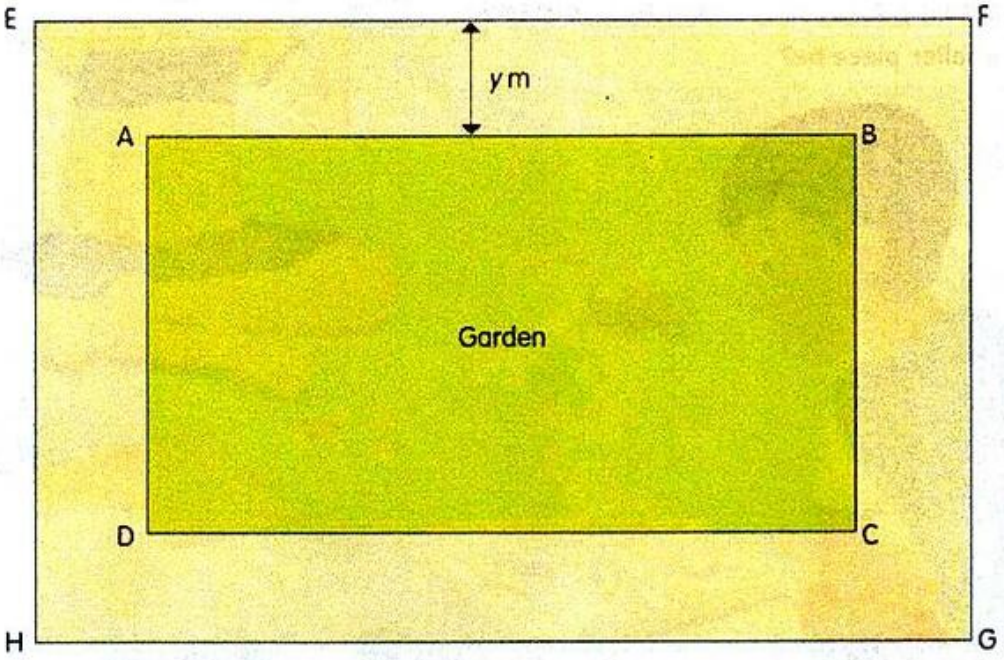
You may want to revisit the following topics:
- P4 Whole Numbers: Word Problems
- P5 Operations of Whole Numbers
- P5 Fractions and Division

Put On Your Thinking Cap!

1. Grace thinks of a number. First, she multiplies it by 2. She then adds 12 to the result. Finally, she takes the result and subtracts twice the number that she first thought of. What is the answer that she will always obtain?

2. The sum of the ages of Kevin and his sister is now 18 years. 3 years from now, Kevin will be half as old as his sister. What are their ages now?

3. A rectangular garden ABCD has a path of width y metres all around it. The perimeter of the path EFGH is 12 m more than the perimeter of the garden ABCD. Find the width of the path in metres.



Workbook A:
Put On Your Thinking Cap!
page 20

CHAPTER 2

Fractions

I used $\frac{1}{6}$ of the yellow wrapping paper to make a yellow rosette. How many yellow rosettes can I make with the remaining yellow wrapping paper?
There is $\frac{2}{5}$ of a block of purple clay left. If I divide it equally into 2 pieces, what fraction of the block will each smaller piece be?

Lessons

1. Dividing a Fraction by a Whole Number
2. Dividing by a Proper Fraction
3. Solving Word Problems

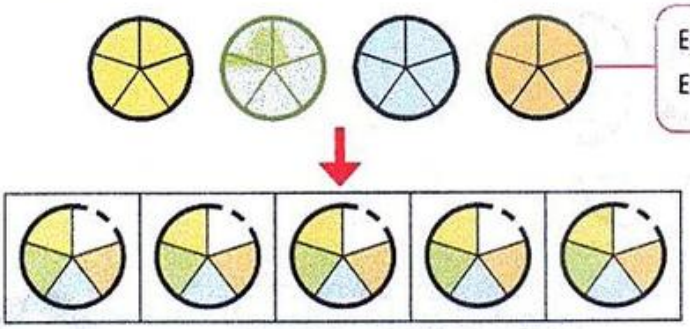
Big Idea

Whole numbers and fractions can be divided in any combination.

Lesson 1 Dividing a Fraction by a Whole Number

Recall

1. Nalika shared 4 identical cakes equally among 5 children. What fraction of a cake did each child get?



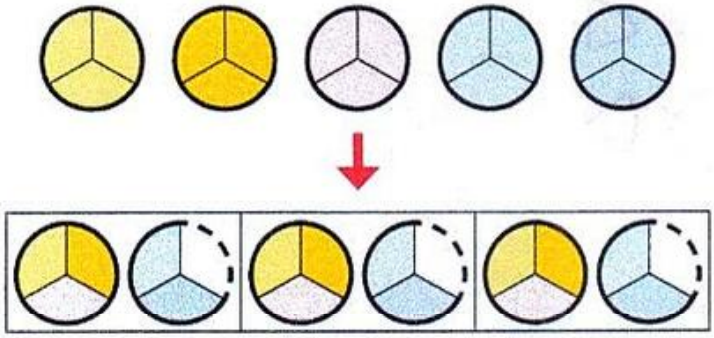
Each cake is divided into 5 equal parts.
Each child will get $\frac{1}{5}$ of each cake.

$4 \div 5 = \frac{4}{5}$

$\frac{4}{5}$ is the same as 4 divided by 5.

Each child got $\frac{4}{5}$ of a cake.

2. Benny made 5 pizzas. The pizzas were divided equally among his 3 sisters. How many pizzas did each sister receive?



$3\overline{)5}$ 1

Give each sister 1 pizza first.

$\frac{3}{2}$

Share the remaining 2 pizzas among the 3 sisters.

$5 \div 3 = 1\frac{2}{3}$

Each sister received $1\frac{2}{3}$ pizzas.

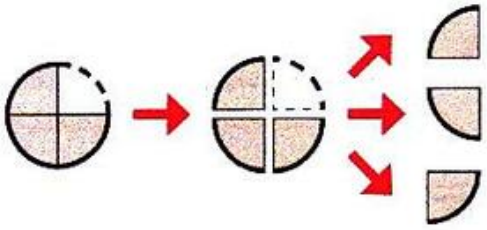
Dividing a fraction by a whole number

Before you learn ...

Alice had $\frac{1}{4}$ of a pizza. She shared the pizza equally with her brother. Use to show how much pizza each of them received. Explain.

LEARN

Share $\frac{3}{4}$ of a pie equally among 3 children. What fraction of the pie does each child get?



$\frac{3}{4} \div 3 = \frac{1}{3}$ of $\frac{3}{4}$

$= \frac{1}{\cancel{3}_1} \times \frac{\cancel{3}^1}{4}$

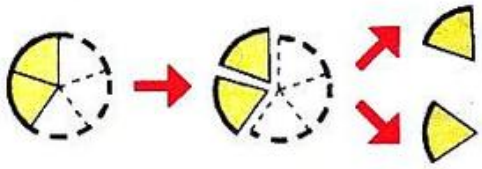
$= \frac{1}{4}$

Each child gets $\frac{1}{4}$ of the pie.

Since $\frac{3}{4}$ of the pie is divided equally among 3 children, each child gets $\frac{1}{3}$ of $\frac{3}{4}$ of the pie.

TRY 1A

Share $\frac{2}{5}$ of a pizza equally between 2 girls. What fraction of the pizza does each girl get?



$\frac{2}{5} \div 2 =$ _____ of _____

$=$ _____ $\times$ _____

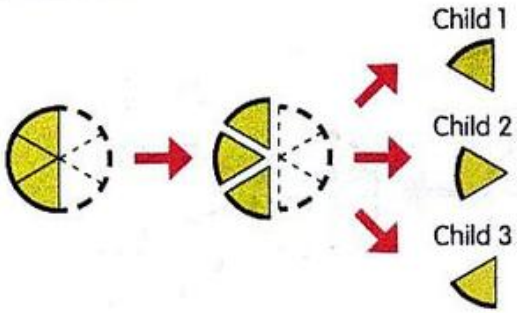
$=$ _____

Each girl gets _____ of the pizza.

LEARN

3 children shared $\frac{1}{2}$ a cake equally. What fraction of the cake did each child receive?

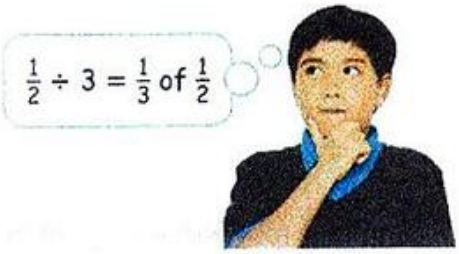
Method 1



$\frac{1}{2} \div 3 = \frac{1}{3} \times \frac{1}{2}$

$= \frac{1}{6}$

Each child received $\frac{1}{6}$ of the cake.

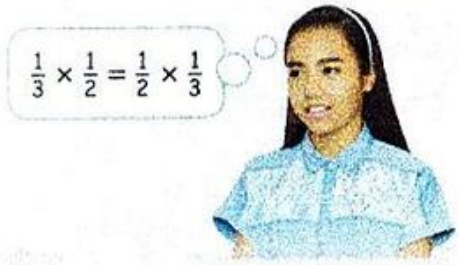


Method 2

$\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3}$

$= \frac{1}{6}$

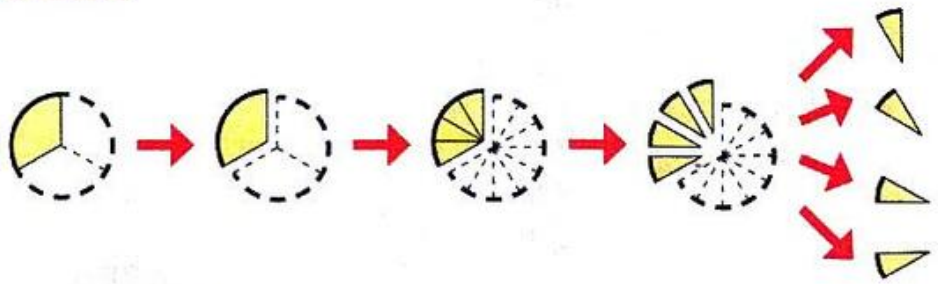
Each child received $\frac{1}{6}$ of the cake.



TRY 18

$\frac{1}{3}$ of a cake was shared equally among 4 people. What fraction of the cake did each person receive?

Method 1



$\frac{1}{3} \div 4 =$ ____ $\times \frac{1}{3}$

$=$ ____

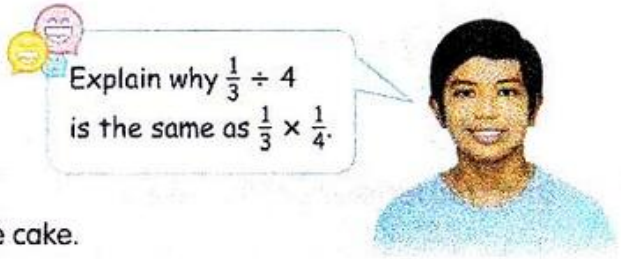
Each person received ____ of the cake.

Method 2

$\frac{1}{3} \div 4 = \frac{1}{3} \times$ ____

$=$ ____

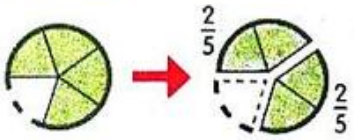
Each person received ____ of the cake.



LEARN

$\frac{4}{5}$ of a fruit tart was shared equally between 2 girls. What fraction of the fruit tart did each girl receive?

Method 1



$\frac{4}{5} \div 2 = \frac{1}{2} \times \frac{4}{5}^{2}$

$= \frac{2}{5}$

Each girl received $\frac{2}{5}$ of the fruit tart.

Method 2

$\frac{4}{5} \div 2 = \frac{4}{5} \times \frac{1}{2}$

$= \frac{2}{5}$

Each girl received $\frac{2}{5}$ of the fruit tart.

LEARN

Divide a fraction by a whole number.

Work in pairs.

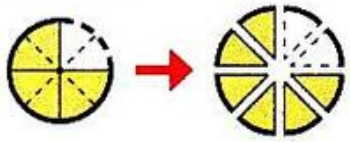
1. Divide $\frac{2}{3}$ equally into two groups. Use to show the fraction in each group. Then, find $\frac{2}{3} \div 2$.
2. Your partner finds $\frac{2}{3} \times \frac{1}{2}$.
3. Compare your answers in 1 and 2. What do you notice?
4. Switch roles. Repeat 1 to 3 with the following. Express each answer in its simplest form.
   a. $\frac{4}{7} \div 2$
   b. $\frac{9}{11} \div 3$

App-tivity @ www.mceducation.com/sgstudent/mapp6

TRY 1C

Miss Tan cut $\frac{3}{4}$ of a block of clay into 6 equal pieces. What fraction of the block of clay was each smaller piece?

Method 1



$\frac{3}{4} \div 6 =$ ____ $\times \frac{3}{4}$

$=$ ____

Each smaller piece was ____ of the block of clay.

Method 2

$\frac{3}{4} \div 6 = \frac{3}{4} \times$ ____

$=$ ____

Each smaller piece was ____ of the block of clay.

TRY 1D

Divide. Express each answer as a fraction in its simplest form.

(a) $\frac{1}{5} \div 4 =$ ____

(b) $\frac{2}{3} \div 8 =$ ____

(c) $\frac{3}{4} \div 12 =$ ____

(d) $\frac{6}{7} \div 9 =$ ____

Maths Sharing

Explore the relationship of dividing two whole numbers and a fraction by a whole number.

1. Share 6 apples equally among 3 children. How many apples does each child receive?
2. What is 6 fifths ÷ 3?
3. What is 6 sevenths ÷ 3?

What do you notice from your answers in 1, 2 and 3?
Discuss and explain.

Workbook A: Practice 1, pages 21–22

Lesson 2 Dividing by a Proper Fraction

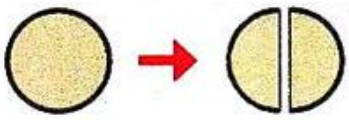
Dividing a whole number by a proper fraction

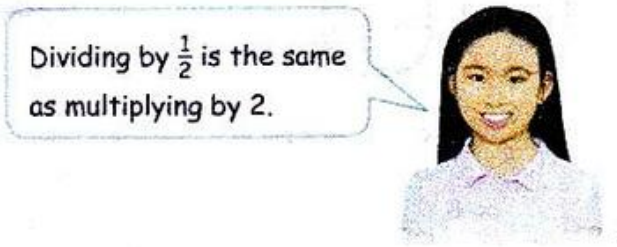
Before you learn ...

Sam had 3 whole waffles. He divided them equally among some children. Each child received $\frac{1}{4}$ of a waffle. Use to show the number of children who shared the waffles.

LEARN

Benny has a pie. He cuts the pie into halves. How many halves are there in 1 whole?





There are 2 halves in 1 whole.

So, $1 \div \frac{1}{2} = 2$.

LEARN

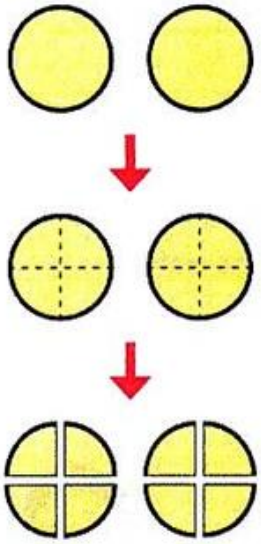
Lili cut a pizza into equal pieces. Each piece was $\frac{1}{3}$ of the pizza. How many equal pieces did Lili cut the pizza into?

$1 \div \frac{1}{3} = 3$

Lili cut the pizza into 3 equal pieces.

LEARN

Roy cut 2 identical cakes into equal pieces. Each piece was $\frac{1}{4}$ of a cake. How many equal pieces did he cut the 2 cakes into?



$2 \div \frac{1}{4} = 2 \times 4$

$= 8$

He cut the 2 cakes into 8 equal pieces.

LEARN

Dividing Wholes by Fractions

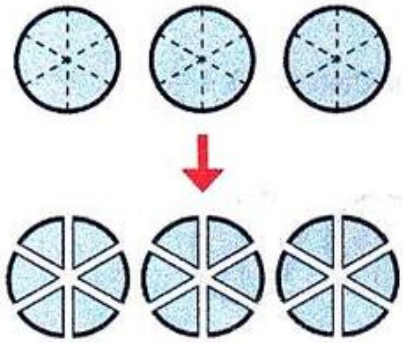
Divide wholes by unit fractions.

Work in pairs.

1. Use to find how many quarters there are in 1 whole. Then, find $1 \div \frac{1}{4}$.
2. Your partner finds 1×4.
3. Compare your answers in 1 and 2. What do you notice?
4. Switch roles. Repeat 1 to 3 to find the following.
   - a. The number of eighths in 1 whole
   - b. The number of thirds in 2 wholes
   - c. The number of fifths in 2 wholes

TRY 1A

Jane cut 3 circles into equal pieces. Each piece was $\frac{1}{6}$ of a circle. How many equal pieces did she cut the circles into?



$3 \div$ ☐ $= 3 \times$ ☐

$=$ ☐

She cut the circles into ☐ equal pieces.

TRY 1B

Divide.

(a) $3 \div \frac{1}{5} =$ ☐ $\times$ ☐

$=$ ☐

(b) $7 \div \frac{1}{4} =$ ☐ $\times$ ☐

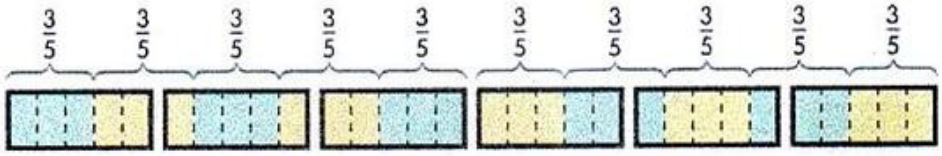
$=$ ☐

(c) $4 \div \frac{1}{2} =$ ☐

(d) $5 \div \frac{1}{3} =$ ☐

LEARN 2

What is $6 \div \frac{3}{5}$?



Number of $\frac{3}{5}$'s in 3 wholes $= 5$

Number of $\frac{3}{5}$'s in 1 whole $= \frac{5}{3}$

Number of $\frac{3}{5}$'s in 6 wholes $= 6 \times \frac{5}{3}$

$6 \div \frac{3}{5} = {}^{2}\cancel{6} \times \frac{5}{\cancel{3}_{1}}$

$= \frac{2 \times 5}{1}$

$= \frac{10}{1}$

$= 10$

LEARN

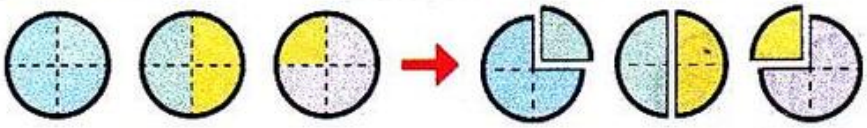
Hands-On Activity

Divide whole numbers by proper fractions.

Work in pairs.

1. Use a pie to find how many $\frac{3}{4}$'s there are in 3 wholes. Then, find $3 \div \frac{3}{4}$.

Example



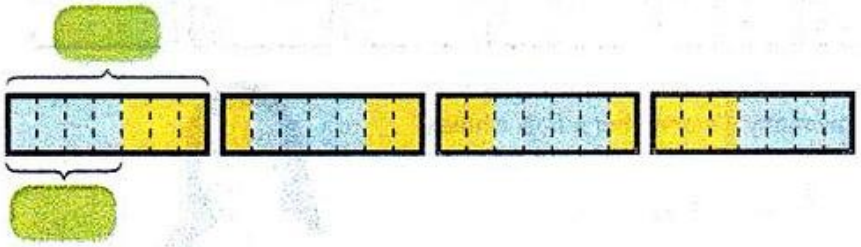
2. Your partner finds $3 \times \frac{4}{3}$.
3. Compare your answers in 1 and 2. What do you notice?
4. Switch roles. Repeat 1 to 3 to find how many $\frac{2}{5}$'s there are in 2 wholes.

App-tivity @ www.mceducation.com/sgstudent/mapp6

TRY 2A

Find the value of each of the following. Explain.

a) $4 \div \frac{4}{7} =$ ▭



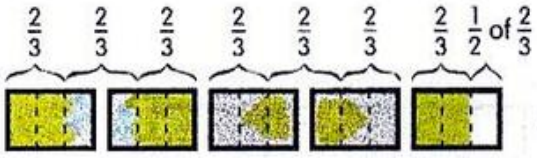
b) $6 \div \frac{2}{7} =$ ▭

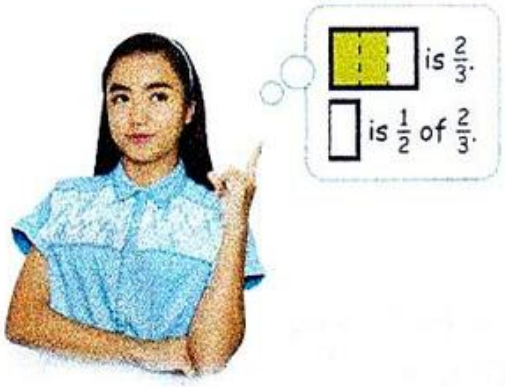
c) $9 \div \frac{3}{8} =$ ▭

d) $10 \div \frac{2}{9} =$ ▭

LEARN

What is $5 \div \frac{2}{3}$?



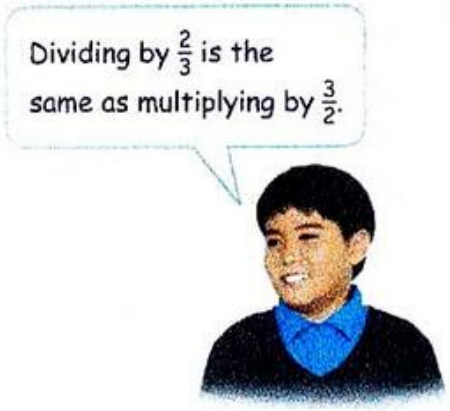


Number of $\frac{2}{3}$'s in 2 wholes = 3

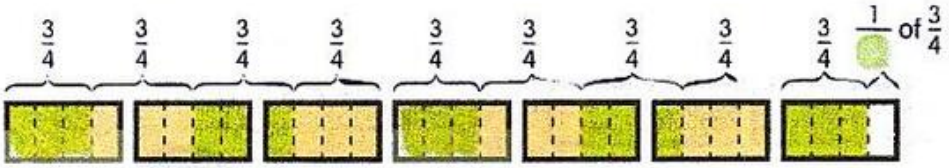
Number of $\frac{2}{3}$'s in 1 whole = $\frac{3}{2}$

Number of $\frac{2}{3}$'s in 5 wholes = $5 \times \frac{3}{2}$

$$5 \div \frac{2}{3} = 5 \times \frac{3}{2}$$
$$= \frac{5 \times 3}{2}$$
$$= \frac{15}{2}$$
$$= 7\frac{1}{2}$$



TRY 2B What is $7 \div \frac{3}{4}$?



Number of $\frac{3}{4}$'s in 3 wholes = ☐

Number of $\frac{3}{4}$'s in 1 whole = ☐

Number of $\frac{3}{4}$'s in 7 wholes = ☐ × ☐

$7 \div \frac{3}{4} = 7 \times$ ☐

$= \frac{\square \times \square}{\square}$

$=$ ☐

$=$ ☐

Dividing by $\frac{3}{4}$ is the same as multiplying by ☐.

TRY 2C Find the value of each of the following. Express each answer as a mixed number in its simplest form.

(a) $5 \div \frac{9}{11} =$ ☐

(b) $10 \div \frac{4}{9} =$ ☐

(c) $12 \div \frac{9}{10} =$ ☐

(d) $14 \div \frac{6}{7} =$ ☐

(e) $8 \div \frac{10}{11} =$ ☐

(f) $15 \div \frac{9}{10} =$ ☐

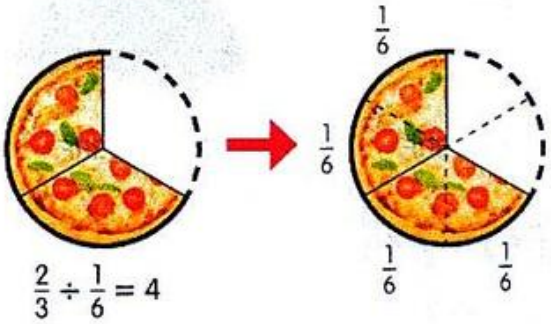
Dividing a proper fraction by a proper fraction

Before you learn ...

Aisyah says that there are 2 quarters in $\frac{1}{2}$. Do you agree? Explain.

LEARN

Devi had $\frac{2}{3}$ of a pizza. She cut it into equal pieces. Each piece was $\frac{1}{6}$ of the pizza.
How many equal pieces did Devi cut it into?



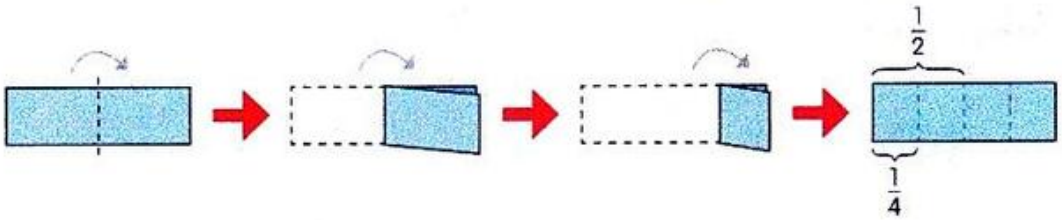
$\frac{2}{3} \div \frac{1}{6} = 4$

Devi cut it into 4 equal pieces.

LEARN **Hands-On Activity** Divide a proper fraction by a proper fraction.

Work in pairs.

1. Fold the rectangular strip of paper provided by your teacher into halves, then quarters. Use your model to find how many quarters there are in $\frac{1}{2}$. Then, find $\frac{1}{2} \div \frac{1}{4}$.



2. Your partner finds $\frac{1}{2} \times 4$.
3. Compare your answers in 1 and 2. What do you notice?
4. Switch roles. Repeat 1 to 3 to find $\frac{1}{2} \div \frac{1}{8}$.

App-tivity @ www.mceducation.com/sgstudent/mapp6

TRY 1A

Jairam's neighbour gave him $\frac{1}{3}$ of a cake. Jairam cut the cake into small pieces. Each small piece is $\frac{1}{6}$ of the original cake. How many small pieces did Jairam cut the cake into?

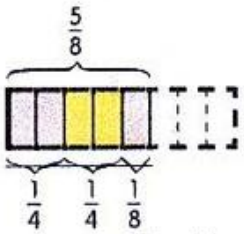
How many sixths are there in $\frac{1}{3}$?

[ ] ÷ [ ] = [ ]

Jairam cut the cake into [ ] small pieces.

LEARN 1B

How many quarters are there in $\frac{5}{8}$?



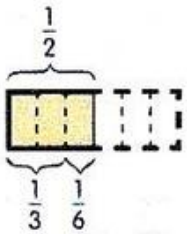
$\left(\frac{1}{2} \text{ of } \frac{1}{4}\right)$

$\frac{5}{8} \div \frac{1}{4} = \frac{5}{2\cancel{8}} \times \frac{\cancel{4}^{1}}{1}$

$= 2\frac{1}{2}$

TRY 1B

How many thirds are there in $\frac{1}{2}$?



$\left(\frac{1}{2} \text{ of } \frac{1}{3}\right)$

[ ] ÷ [ ] = [ ] × [ ]

= [ ]

TRY 1C

Find the value of each of the following in its simplest form. Explain.

a $\frac{2}{3} \div \frac{1}{9} =$ [ ]

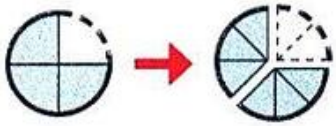
b $\frac{3}{4} \div \frac{1}{12} =$ [ ]

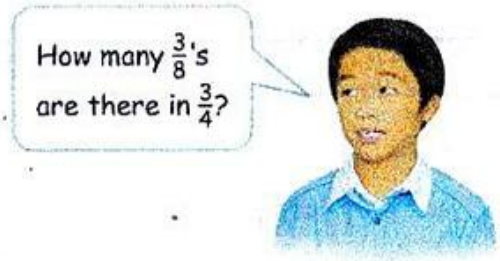
c $\frac{5}{6} \div \frac{1}{3} =$ [ ]

d $\frac{4}{9} \div \frac{1}{7} =$ [ ]

LEARN

Mary had $\frac{3}{4}$ of a waffle. She cut it into equal pieces. Each piece was $\frac{3}{8}$ of the waffle. How many equal pieces did she cut it into?



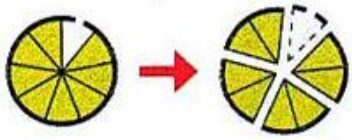


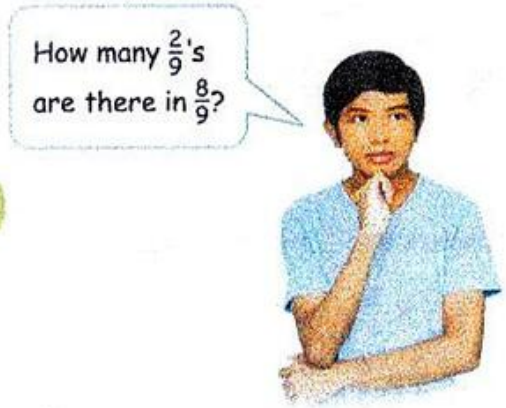
$$\frac{3}{4} \div \frac{3}{8} = \frac{6}{8} \div \frac{3}{8}$$
$$= \frac{6}{\cancel{8}_{1}} \times \frac{\cancel{8}^{1}}{3}$$
$$= 2$$

She cut it into 2 equal pieces.

TRY 2A

Hadi had $\frac{8}{9}$ of a cake and some plates. He put $\frac{2}{9}$ of the cake on each plate. How many plates did he have?



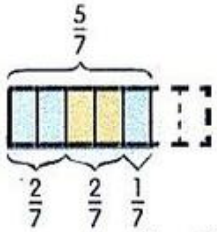


$$\square \div \square = \square \times \square$$
$$= \square$$

He had $\square$ plates.

LEARN

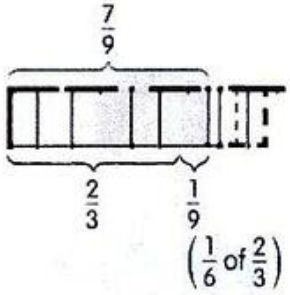
How many $\frac{2}{7}$'s are there in $\frac{5}{7}$?



$\left(\frac{1}{2} \text{ of } \frac{2}{7}\right)$

$$\frac{5}{7} \div \frac{2}{7} = \frac{5}{\cancel{7}_{1}} \times \frac{\cancel{7}^{1}}{2}$$
$$= 2\frac{1}{2}$$

TRY 2B Find $\frac{7}{9} \div \frac{2}{3}$.



$\frac{7}{9} \div \frac{2}{3} =$ ☐ $\times$ ☐

$=$ ☐

TRY 2C Find the value of each of the following. Express your answer as a mixed number or fraction in its simplest form.

a) $\frac{3}{8} \div \frac{5}{6} =$ ☐

b) $\frac{7}{10} \div \frac{5}{12} =$ ☐

c) $\frac{5}{6} \div \frac{7}{8} =$ ☐

d) $\frac{3}{5} \div \frac{3}{10} =$ ☐

Robin's solution to $\frac{6}{7} \div \frac{3}{8}$ is as shown.

$\frac{{}^{3}\cancel{6}}{7} \div \frac{3}{\cancel{8}_{4}} = \frac{3}{7} \times \frac{3}{4}$

$= \frac{{}^{1}\cancel{3}}{7} \times \frac{4}{\cancel{3}_{1}}$

$= \frac{1}{7} \times \frac{4}{1}$

$= \frac{4}{7}$

Do you agree with Robin's solution? Why?
Explain how you would divide a fraction by another fraction. Give an example.

Workbook A: Practice 2, pages 23–26

Lesson 3

Solving Word Problems

Solving word problems

Before you learn ...

Marvin had $\frac{3}{4}$ of a pie. He cut it into a few slices. Each slice was $\frac{1}{8}$ of the whole pie.
Draw a model to show the number of slices he cut the pie into.

LEARN

A machine processes $\frac{1}{10}$ kg of sugar every minute. How many minutes will it take for the machine to process 2 kg of sugar?

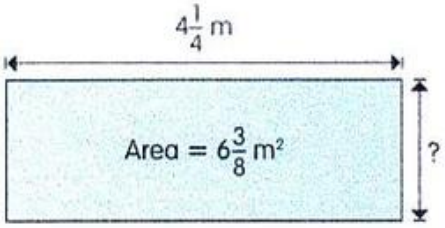
$2 \div \frac{1}{10} = 2 \times 10$

$= 20$

It will take 20 minutes for the machine to process 2 kg of sugar.

LEARN

A rectangular garden has a length of $4\frac{1}{4}$ m. Its area is $6\frac{3}{8}$ m^2.
What is the breadth of the garden?



$6\frac{3}{8} \div 4\frac{1}{4} = 1\frac{1}{2}$

The breadth of the garden is $1\frac{1}{2}$ m.

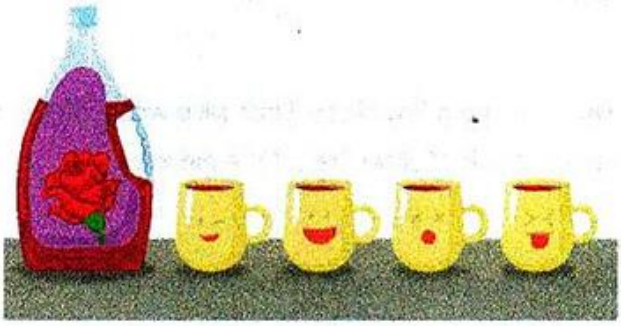
Area of rectangle = Length × Breadth

LEARN

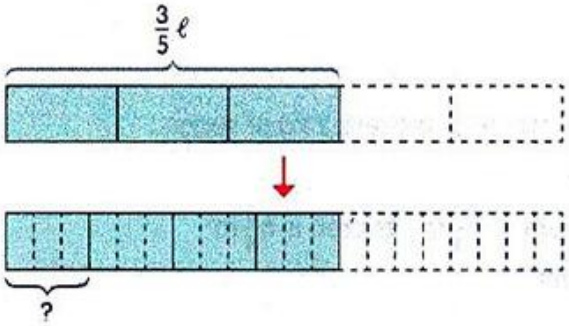
Tammy had $\frac{3}{5}\ \ell$ of rose syrup. She poured the rose syrup equally into 4 cups.

(a) Find, in litres, the amount of rose syrup in each cup.

(b) She bought another 3 ℓ of rose syrup and poured the same amount of rose syrup as before into some additional cups. How many more cups could she fill?



(a)



$\frac{3}{5} \div 4 = \frac{3}{5} \times \frac{1}{4}$

$= \frac{3}{20}$

There was $\frac{3}{20}\ \ell$ of rose syrup in each cup.

(b) $3 \div \frac{3}{20} = {}^{1}\cancel{3} \times \frac{20}{\cancel{3}_{1}}$

$= 20$

She could fill 20 more cups.

LEARN

A carnival organiser used $\frac{2}{9}$ of a rectangular field to build the stage and another $\frac{1}{9}$ of it to set up the admission counter. He then divided the rest of the field into several small parts for the stalls. Each small part was $\frac{1}{18}$ of the field.

(a) How many small parts were there?

(b) The area of the field was 90 m². What was the area of each small part?

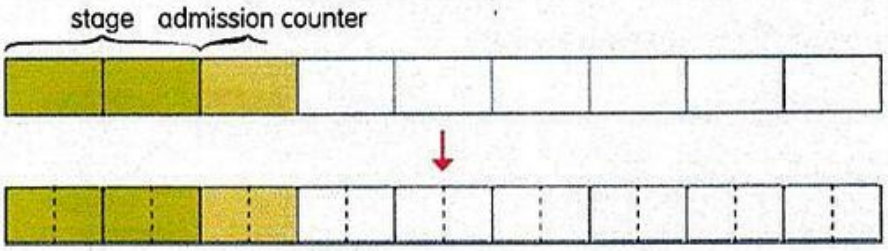
Step 1 What have I gathered from the problem?

What fraction of the field did the carnival organiser use to build the stage and the admission counter? What fraction of the field did the organiser have left?

Step 2 How do I solve it?
I can draw a model.

Step 3 What do I need to find?
I need to find how many small parts there were.
Then, I need to find the area of each part.

Method 1



(a) There were 12 small parts.

(b) 18 units = 90
1 unit = 90 ÷ 18
= 5

Each small part was 5 m².

Method 2

(a) $1 - \frac{2}{9} - \frac{1}{9} = \frac{6}{9}$

$\frac{6}{9} \div \frac{1}{18} = \frac{6}{\cancel{9}_{1}} \times \cancel{18}^{2}$

$= 12$

There were 12 small parts.

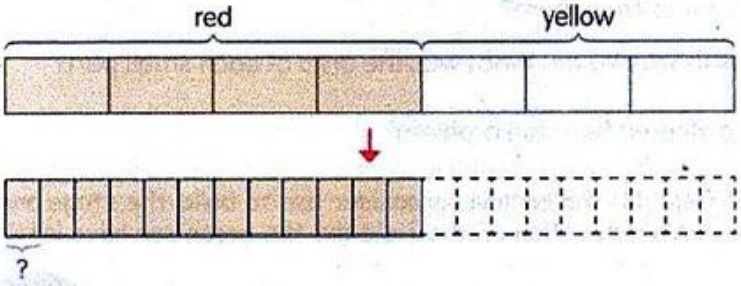
(b) $\frac{1}{18} \times 90 = 5$

Each small part was 5 m².

Step 4 How can I check my answer?
I can work backwards to check my answer.

TRY 1A

A basket contained red and yellow tomatoes. $\frac{4}{7}$ of the tomatoes were red. All the red tomatoes were packed equally into 12 bags. What fraction of all the tomatoes from the basket was packed into each bag?



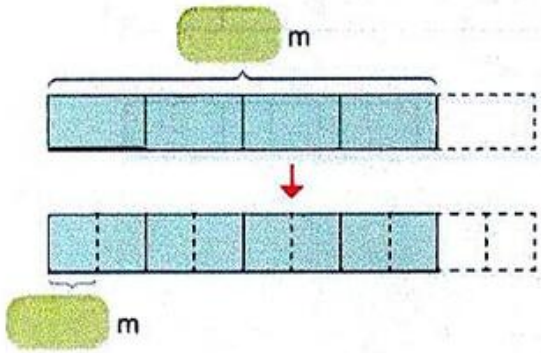
$\frac{4}{7} \div 12 = \frac{4}{7} \times$ ☐

$=$ ☐

☐ of all the tomatoes was packed into each bag.

TRY 1B

A plank is $\frac{4}{5}$ m long. A worker cuts it into equal pieces, each $\frac{1}{10}$ m long. How many pieces did he cut the plank into?



☐ $\div$ ☐ $=$ ☐ $\times$ ☐

$=$ ☐

He cut the plank into ☐ pieces.

TRY 1C

Kassim packed $9\frac{1}{10}$ kg of minced meat equally into 7 bags and sold each bag of minced meat for \$5.20. Hassan packed $8\frac{2}{5}$ kg of minced meat equally into 6 bags and sold each bag of minced meat for \$5.25. Who would you buy minced meat from? Explain. ☐

TRY 1b

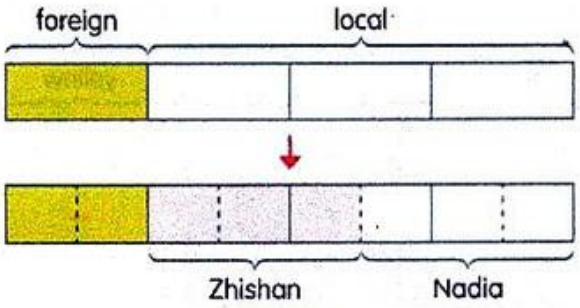
Rachel had some local and foreign stamps. $\frac{1}{4}$ of them were foreign stamps. She divided the local stamps equally between two friends, Zhishan and Nadia.

(a) What fraction of the total number of stamps did they each receive?

(b) Rachel had 72 stamps altogether. How many stamps did Nadia receive?

Method 1

(a)



They each received ____ of the total number of stamps.

(b) 8 units = ____

1 unit = ____ ÷ ____

= ____

3 units = ____ × ____

= ____

Nadia received ____ stamps.

Method 2

(a) 1 − ____ = ____

____ of Rachel's stamps were local stamps.

____ ÷ ____ = ____ × ____

= ____

They each received ____ of the total number of stamps.

(b) ____ × 72 = ____

Nadia received ____ stamps.

TRY 1E

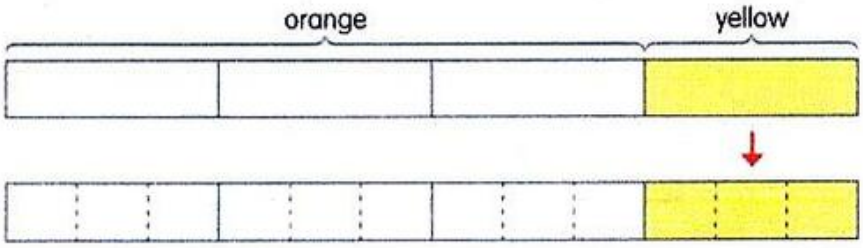
$\frac{3}{4}$ of the gummy rings in a jar were orange and the rest were yellow. Raine packed the yellow gummy rings equally into bags. The number of yellow gummy rings in each bag was $\frac{1}{12}$ of the total number of gummy rings.

(a) How many bags of yellow gummy rings did Raine pack?

(b) There were 72 orange gummy rings. How many yellow gummy rings were there in each bag?

Method 1

(a)



Raine packed _____ bags of yellow gummy rings.

(b) _____ units = 72

1 unit = 72 ÷ _____

= _____

There were _____ yellow gummy rings in each bag.

Method 2

(a) 1 − _____ = _____

_____ of the gummy rings in the jar were yellow.

_____ ÷ _____ = _____ × _____

= _____

Raine packed _____ bags of yellow gummy rings.

(b) Number of yellow gummy rings = _____ ÷ _____

= _____

_____ ÷ _____ = _____

There were _____ yellow gummy rings in each bag.

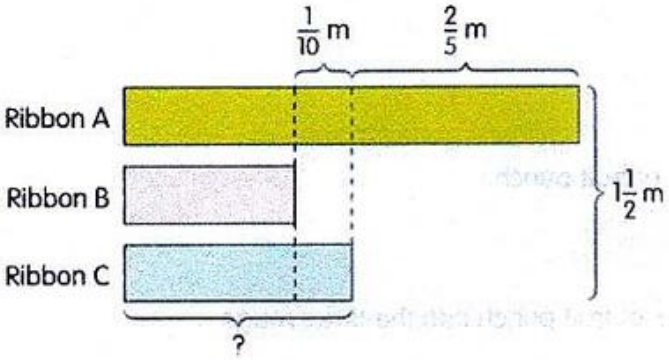
LEARN

Ribbon A is $\frac{2}{5}$ m longer than Ribbon C. Ribbon C is $\frac{1}{10}$ m longer than Ribbon B. The total length of all the three ribbons is $1\frac{1}{2}$ m.

(a) How long is Ribbon B? Express your answer as a fraction in its simplest form.

(b) How long is Ribbon C? Express your answer as a fraction in its simplest form.

Use the four-step problem-solving method to help you.
Then, work backwards to check if your answer is reasonable.



(a) $\frac{1}{10} + \frac{1}{10} + \frac{2}{5} = \frac{1}{10} + \frac{1}{10} + \frac{4}{10}$

$= \frac{6}{10}$

$1\frac{1}{2} - \frac{6}{10} = 1\frac{5}{10} - \frac{6}{10}$

$= \frac{15}{10} - \frac{6}{10}$

$= \frac{9}{10}$

$\frac{9}{10} \div 3 = \frac{\overset{3}{\cancel{9}}}{10} \times \frac{1}{\cancel{3}_1}$

$= \frac{3}{10}$

Ribbon B is $\frac{3}{10}$ m long.

(b) $\frac{3}{10} + \frac{1}{10} = \frac{4}{10}$

$= \frac{2}{5}$

Ribbon C is $\frac{2}{5}$ m long.

TRY 2

Anuar mixed $2\frac{1}{4}$ ℓ of peach juice and $1\frac{3}{5}$ ℓ of apple juice to make a fruit punch. He kept 3 ℓ and poured the rest into three mugs, A, B and C. The amount of fruit punch in Mug B was twice the amount of fruit punch in Mug A. Mug C contained $\frac{1}{10}$ ℓ of fruit punch more than Mug B.

(a) How much fruit punch did Anuar pour into the three mugs?

(b) Find the amount of fruit punch in Mug A. Express your answer as a fraction in its simplest form.

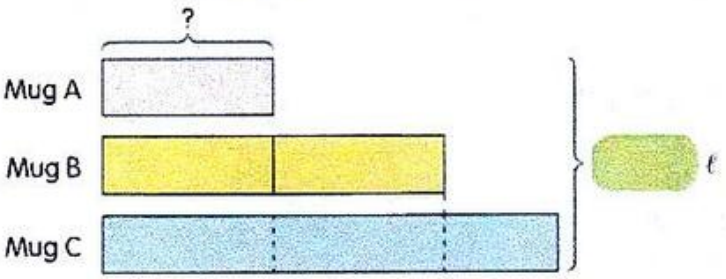
(a) $2\frac{1}{4}$ ☐ $1\frac{3}{5}$ = ☐

Anuar made ☐ ℓ of fruit punch.

☐ − ☐ = ☐

Anuar poured ☐ ℓ of fruit punch into the three mugs.

(b)



☐ − ☐ = ☐ − ☐

= ☐

☐ ÷ ☐ = ☐ × ☐

= ☐

The amount of fruit punch in Mug A was ☐ ℓ.

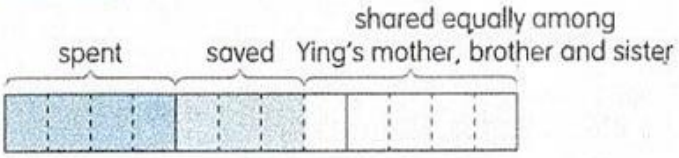
LEARN

Each month, Ying spends $\frac{1}{3}$ of her salary, saves $\frac{3}{8}$ of the remainder and shares the rest equally among her mother, brother and sister.

a) What fraction of her salary does each of them receive?

b) Ying's salary is \$5400. How much does she give her mother each month?

Method 1



a) $\frac{5}{12} \div 3 = \frac{5}{12} \times \frac{1}{3}$

$= \frac{5}{36}$

Each of them receives $\frac{5}{36}$ of her salary.

b) Ying's salary = \$5400

$\frac{1}{36}$ of Ying's salary = \$5400 ÷ 36

= \$150

$\frac{5}{36}$ of Ying's salary = \$150 × 5

= \$750

She gives her mother \$750 each month.

Method 2

a) $\frac{1}{4}\cancel{8} \times \frac{2}{\cancel{8}_1}^1 = \frac{1}{4}$

Ying saves $\frac{1}{4}$ of her salary.

$1 - \frac{1}{3} - \frac{1}{4} = 1 - \frac{4}{12} - \frac{3}{12}$

$= \frac{5}{12}$

Ying shares $\frac{5}{12}$ of her salary among her mother, brother and sister.

$\frac{5}{12} \div 3 = \frac{5}{12} \times \frac{1}{3}$

$= \frac{5}{36}$

Each of them receives $\frac{5}{36}$ of her salary.

b) $\frac{5}{36} \times \text{\$5400} = \text{\$750}$

She gives her mother \$750 each month.

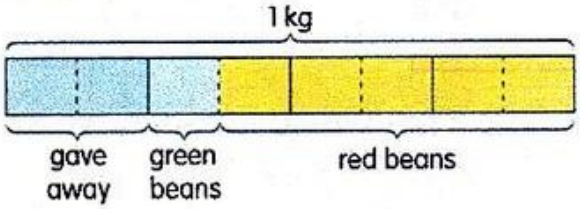
TRY 3

Jaya buys 1 kg of beans and gives away $\frac{1}{4}$ kg of it. $\frac{1}{6}$ of the remaining beans are green and the rest are red. Jaya packs the red beans equally into 10 packs.

(a) What is the mass of red beans in each pack? Express your answer as a fraction in its simplest form.

(b) Jaya wants to sell 2 kg of red beans. How many of such packs does she need?

(a) **Method 1**



[ ] ÷ 10 = [ ] × $\frac{1}{10}$

= [ ]

The mass of red beans in each pack is [ ] kg.

Method 2

$1 - \frac{1}{4}$ = [ ]

Jaya has [ ] kg of beans left after giving away $\frac{1}{4}$ kg of beans.

1 − [ ] = [ ]

[ ] of the remaining beans are red.

[ ] × [ ] = [ ]

The red beans have a total mass of [ ] kg.

[ ] ÷ 10 = [ ] × [ ]

= [ ]

The mass of red beans in each pack is [ ] kg.

(b) [ ] ÷ [ ] = [ ] × [ ]

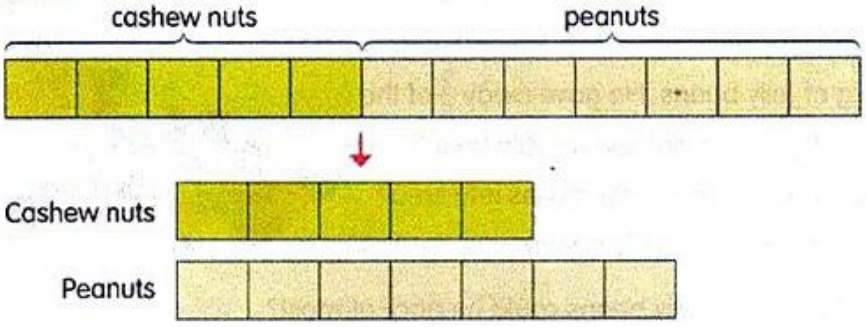
= [ ]

She needs [ ] such packs.

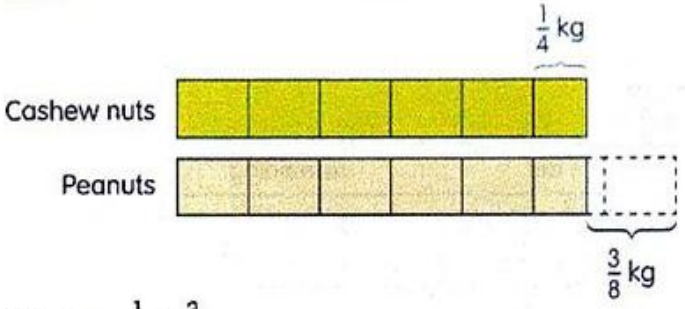
LEARN

$\frac{5}{12}$ of the mass of nuts Hakim had belonged to cashew nuts and the rest belonged to peanuts. After he bought another $\frac{1}{4}$ kg of cashew nuts and gave away $\frac{3}{8}$ kg of peanuts, he had an equal mass of cashew nuts and peanuts. Find the mass of the cashew nuts he had at first. Give your answer as a mixed number in its simplest form.

Before



After



$2 \text{ units} = \frac{1}{4} + \frac{3}{8}$

$= \frac{2}{8} + \frac{3}{8}$

$= \frac{5}{8}$

$1 \text{ unit} = \frac{5}{8} \div 2$

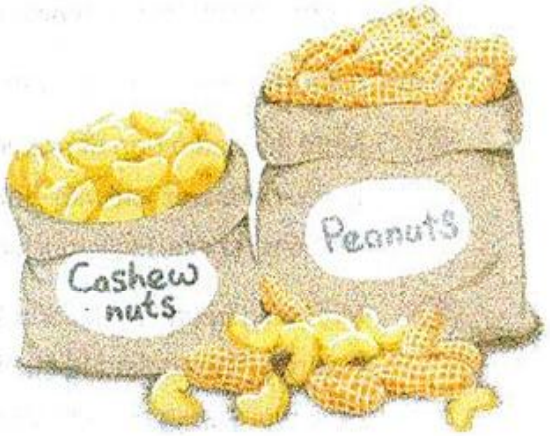
$= \frac{5}{8} \times \frac{1}{2}$

$= \frac{5}{16}$

$5 \text{ units} = \frac{5}{16} \times 5$

$= \frac{25}{16}$

$= 1\frac{9}{16}$



The mass of cashew nuts he had at first was $1\frac{9}{16}$ kg.

LEARN

Hands-On Activity

Solve word problems.

Work in pairs.

STRATEGY

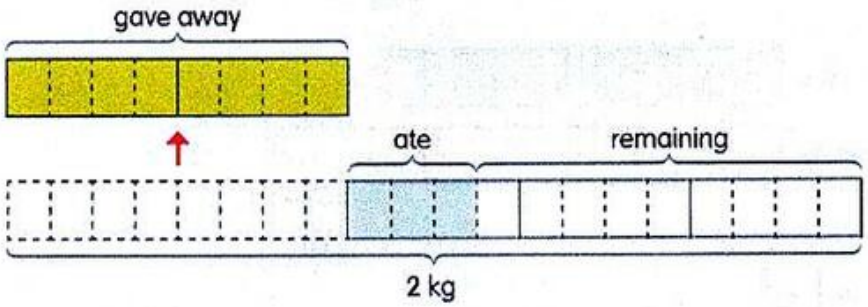
1. Read the word problem. Draw a model for the problem.

Example

James had 2 kg of jelly beans. He gave away $\frac{2}{5}$ of the jelly beans and ate $\frac{1}{4}$ of the remaining jelly beans. He then packed the remaining jelly beans into small bags each containing $\frac{1}{5}$ kg of jelly beans.

   a. How many bags of jelly beans could he pack at most?

   b. What was the mass of the jelly beans left unpacked?



2. Use the model to solve the problem.

3. Your partner checks your answers using a calculator.

4. Switch roles. Repeat 1 to 3 with these problems.

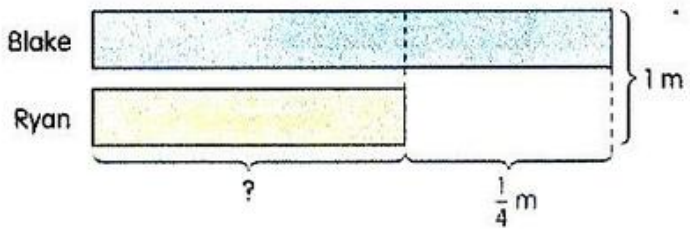
   a. Mdm Rai had a bag of rice. She cooked an equal amount of rice each day. After 2 days, she was left with $\frac{4}{5}$ of the bag of rice. After another 5 days, she was left with 6 kg of rice. How much rice was there in the bag at first?

   b. Mrs Heng bought $1\frac{1}{4}$ kg of minced meat on Monday and another $1\frac{1}{8}$ kg on Tuesday. She cooked $1\frac{5}{8}$ kg of it and divided the rest into $\frac{1}{8}$-kg portions. How many $\frac{1}{8}$-kg portions were there?

1. Read the word problem. Draw a model for the problem.

Example

Blake and Ryan shared a 1-m long ribbon. The piece of ribbon that Blake received was $\frac{1}{4}$ m longer than the piece that Ryan received. What was the length of the ribbon in metres, that Ryan received?



2. Use the model to solve the problem.

3. Your partner checks your answers using a calculator.

4. Switch roles. Repeat 1 to 3 with these problems.

   a. A jug is $\frac{2}{5}$ filled with milk. All the milk from the jug is poured into an empty cup. The capacity of the jug is twice that of the cup.

      i. What fraction of the cup is filled?

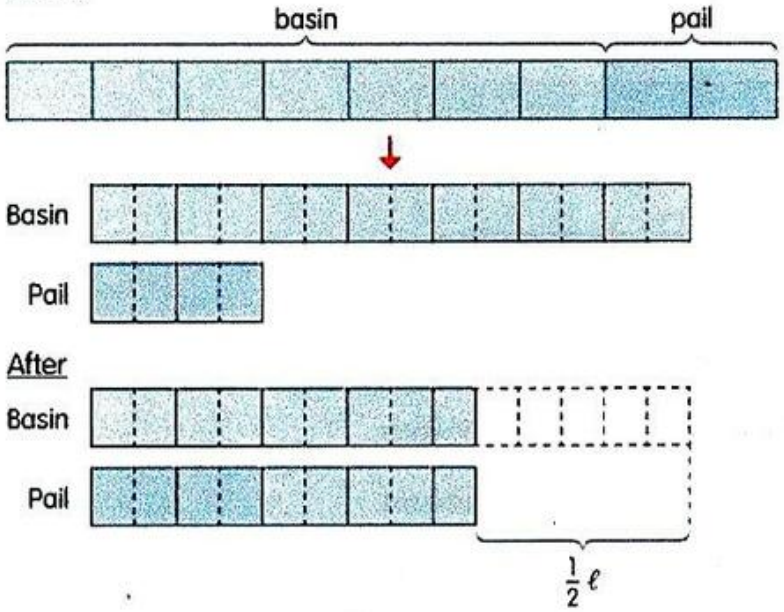
      ii. The volume of milk in the cup is $\frac{1}{2}$ ℓ. What is the capacity of the jug? Express your answer as a mixed number in its simplest form.

   b. Amira put a bag of apples and a bag of bananas into an empty box. The mass of the bananas was $\frac{2}{9}$ of the total mass of the two types of fruits in the box. She then sold an equal mass of apples and bananas. The mass of apples left was $\frac{1}{2}$ kg more than the mass of bananas left. Find the mass of apples she had at first.

TRY 4

Hafiz poured $\frac{7}{9}$ of the water in a tank into a basin and the rest into a pail. He then poured $\frac{1}{2}\ \ell$ of water from the basin into the pail. Both the basin and the pail had an equal amount of water in the end. How much water was poured into the basin at first? Express your answer as a mixed number in its simplest form.

Before



[ ] units = [ ]

1 unit = [ ] ÷ [ ]

= [ ] × [ ]

= [ ]

[ ] units = [ ] × [ ]

= [ ]

The amount of water in the basin at first was [ ] ℓ.

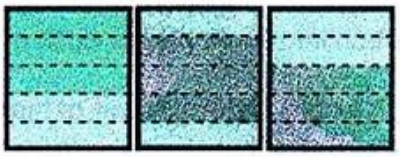
Workbook A: Practice 3, pages 27–38

Chapter 2 Review

1 Use the models to find the answers.

a $1 \div \frac{1}{4} =$ ____

b $3 \div \frac{3}{5} =$ ____



c $\frac{3}{4} \div \frac{1}{8} =$ ____

d $\frac{2}{3} \div \frac{2}{9} =$ ____

2 Divide. Express your answer in its simplest form.

a $\frac{1}{7} \div 2 =$ ____ **b** $\frac{9}{11} \div 3 =$ ____ **c** $\frac{8}{9} \div 6 =$ ____

d $12 \div \frac{1}{3} =$ ____ **e** $6 \div \frac{3}{8} =$ ____ **f** $10 \div \frac{4}{5} =$ ____

g $\frac{1}{4} \div \frac{1}{3} =$ ____ **h** $\frac{3}{5} \div \frac{7}{10} =$ ____ **i** $\frac{3}{4} \div \frac{9}{11} =$ ____

3. 4 cakes were shared among a group of children. Each child got $\frac{2}{9}$ of a cake. How many children were there in the group?

4. Mitra has $\frac{4}{5}\ \ell$ of cranberry juice in a jug. She pours $\frac{1}{4}\ \ell$ into each glass.

   a. What is the greatest number of glasses of cranberry juice Mitra can have?

   b. How much cranberry juice will there be left in the jug?

5. A roll of ribbon was 8 m long. Priya cut 10 pieces of ribbon, each of length $\frac{2}{5}$ m, to tie some presents. She then cut the remaining ribbon into some pieces, each of length $\frac{3}{4}$ m.

   a. How many pieces of ribbon, each $\frac{3}{4}$ m in length, did Priya have at most?

   b. What was the length of ribbon left?

6. $\frac{4}{11}$ of the seafood in a fridge was prawns and the rest was crayfish. After Mr Kang cooked an equal mass of prawns and crayfish, there was $\frac{3}{4}$ kg more crayfish than prawns left. Find the mass of the prawns at first.

7. Mr Fadzil used $1\frac{2}{5}$ m of cloth to make 2 identical phone cases and a cushion cover. He used $\frac{3}{5}$ m more cloth to make the cushion cover than the 2 phone cases. What was the length of cloth used for each phone case?

8 Butcher A sold ribs at $5\frac{1}{2}$ kg for \$66. Butcher B sold ribs at $5\frac{3}{5}$ kg for \$56. Mrs Poh bought $2\frac{1}{2}$ kg of ribs from a butcher at \$25. Which butcher did she buy from? Explain.

9 Mrs Edwards spent $\frac{3}{5}$ of her money on 4 identical sharpeners and 6 identical pairs of scissors. She then bought 8 more of the same sharpener using $\frac{1}{2}$ of her remaining money. Each sharpener cost \$0.75. How much money did Mrs Edwards spend on each pair of scissors?

LOOK BACK 10 P4 Fractions

There are 56 markers in a shop. $\frac{3}{8}$ of the markers are erasable markers. The rest are permanent markers. How many permanent markers are there?

LOOK BACK 11 P5 Fractions

Vicky bought $3\frac{1}{2}$ ℓ of guava juice. She gave $1\frac{3}{5}$ ℓ of the guava juice to her neighbour. How much guava juice did she have left?

LOOK BACK 12 P5 Fractions

There were 96 coins in a box. $\frac{1}{3}$ of the coins were \$1 coins, $\frac{1}{4}$ of the remaining coins were 50¢ coins and the rest were 10¢ coins.

a How many 10¢ coins were there?

b Find the total value of all the coins in the box.

LOOK BACK 13 P5 Fractions

Rani used $\frac{3}{8}$ of her money to buy some blouses and $\frac{2}{5}$ of the remainder to buy 2 pairs of jeans. A pair of jeans cost 3 times as much as a blouse. How many blouses did she buy?

Workbook A:
Chapter 4 Review, pages 39–43
Maths Journal, page 44

Chapter Wrap-Up

Fractions

Dividing Fractions by Whole Numbers

- $\frac{4}{7} \div 8 = \frac{\cancel{4}^{1}}{7} \times \frac{1}{\cancel{8}_{2}}$

$= \frac{1}{14}$

Dividing Whole Numbers by Proper Fractions

- $12 \div \frac{3}{8} = \cancel{12}^{4} \times \frac{8}{\cancel{3}_{1}}$

$= 32$

- $9 \div \frac{6}{11} = 9 \times \frac{11}{6}$

$= \frac{99}{6}$

$= \frac{33}{2}$

$= 16\frac{1}{2}$

Dividing Proper Fractions by Proper Fractions

- $\frac{5}{6} \div \frac{10}{11} = \frac{\cancel{5}^{1}}{6} \times \frac{11}{\cancel{10}_{2}}$

$= \frac{11}{12}$

Solving Word Problems

You may want to revisit the following topics:

- P4 Fractions
- P5 Fractions

Put On Your Thinking Cap!

1. What is the fraction that is exactly between $\frac{5}{9}$ and $\frac{8}{9}$?

2. Find the value of $\frac{11}{12} \div \frac{11}{10} \times \frac{9}{10} \div \frac{9}{8} \times \frac{7}{8} \div \frac{7}{6}$.

3. Mrs Ong had some cookies. She packed the cookies equally into packets of $\frac{1}{5}$ kg each. If she packs them equally into packets of $\frac{1}{8}$ kg each, she will get 12 more packets of cookies. Given that the total mass of the cookies is a whole number, how many kilograms of cookies did she have?

Workbook A:
Put On Your Thinking Cap! pages 45–46
Review 1, pages 47–54

CHAPTER 3

Ratio

If each person gets 1 serving, how much of each ingredient do we need in order to bake for 32 people?
The amount of sugar needed is $\frac{1}{3}$ of the amount of butter needed. What is the ratio of the amount of sugar needed to the amount of butter needed?
Chocolate Croissant
Servings: 8
Ingredients:
120 ml warm milk
250 g bread flour
$\frac{1}{2}$ teaspoon salt
150 g butter
50 g sugar
7 g dry yeast
227 g chocolate chips
1 egg yolk
Bread Flour
Dry Yeast

Lessons

1. Ratio and Fraction
2. Comparing Ratios
3. Solving Word Problems

Big Idea

Ratios and fractions can be used to show the relationship between two quantities.

Lesson 1 Ratio and Fraction

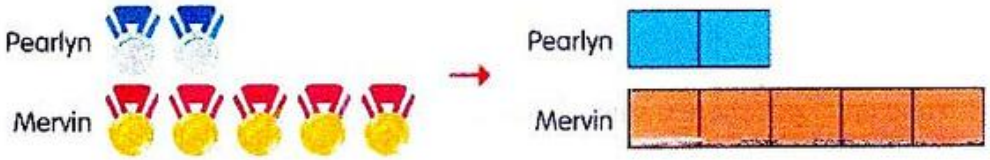
Relating ratio and fraction

Before you learn ...

Take some and . What is the ratio of the number of red cubes to the total number of cubes? What fraction of the total number of cubes are red? What do you notice about the ratio and the fraction? Explain.

LEARN

Pearlyn has 2 taekwondo medals. Mervin has 5 taekwondo medals.
The number of medals they have can be shown using a model.



The ratio of the number of medals Pearlyn has to the number of medals Mervin has is 2 : 5.

The same ratio can be expressed as a fraction:

$$\frac{\text{Number of medals Pearlyn has}}{\text{Number of medals Mervin has}} = \frac{2}{5}$$

The number of medals Pearlyn has is $\frac{2}{5}$ of the number of medals Mervin has.

The numerator of the fraction refers to the first quantity of the ratio and the denominator refers to the second quantity of the ratio.

The ratio of the number of medals Mervin has to the number of medals Pearlyn has is 5 : 2.

The same ratio can be expressed as a fraction:

$$\frac{\text{Number of medals Mervin has}}{\text{Number of medals Pearlyn has}} = \frac{5}{2}$$

The number of medals Mervin has is $\frac{5}{2}$ of the number of medals Pearlyn has.

LEARN 15

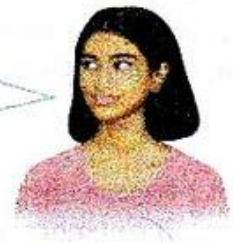
Sharon places 3 apples and 4 pears on a tray.

The ratio of the number of apples to the number of pears is 3 : 4.

Total number of fruits = 3 + 4
= 7

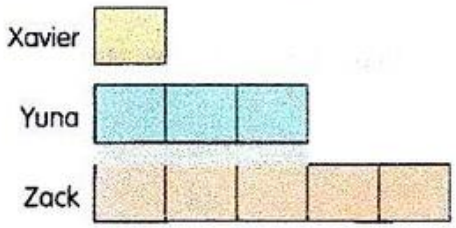
The number of apples is $\frac{3}{7}$ of the total number of fruits.

The number of pears is $\frac{4}{7}$ of the total number of fruits.



LEARN 16

Xavier, Yuna and Zack share a sum of money in the ratio 1 : 3 : 5.



The amount of money Xavier received is $\frac{1}{3}$ of the amount of money Yuna received.

The amount of money Zack received is $\frac{5}{3}$ of the amount of money Yuna received.

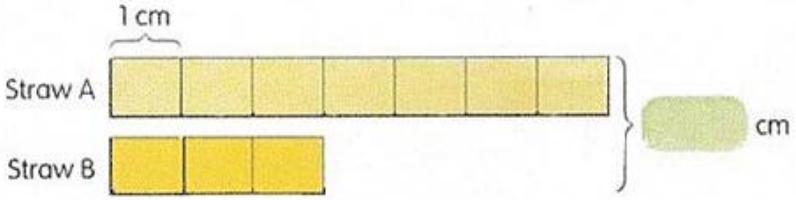
Total amount of money = 1 + 3 + 5
= 9 units

The ratio of the amount of money Xavier received to the total amount of money is 1 : 9.
The amount of money Xavier received is $\frac{1}{9}$ of the total amount of money.

The ratio of the amount of money Yuna received to the total amount of money is 3 : 9 = 1 : 3.
The amount of money Yuna received is $\frac{1}{3}$ of the total amount of money.

TRY 1A

Straw A is 7 cm long. Straw B is 3 cm long.



The ratio of the length of Straw A to the length of Straw B is ____ : ____.

$\frac{\text{Length of Straw A}}{\text{Length of Straw B}} =$ ____

The length of Straw A is ____ of the length of Straw B.

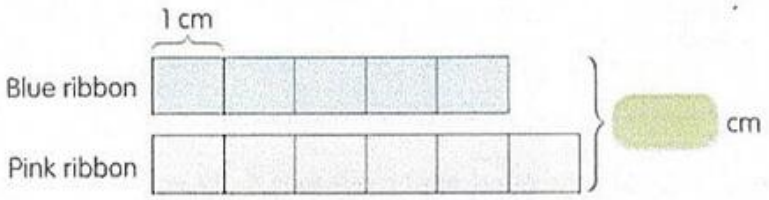
The ratio of the length of Straw B to the length of Straw A is ____ : ____.

$\frac{\text{Length of Straw B}}{\text{Length of Straw A}} =$ ____

The length of Straw B is ____ of the length of Straw A.

TRY 1B

A blue ribbon is 5 cm long. A pink ribbon is 6 cm long.



The ratio of the length of the blue ribbon to the length of the pink ribbon is ____ : ____.

Total length of the two ribbons = ____ cm

$\frac{\text{Length of the blue ribbon}}{\text{Total length of the two ribbons}} =$ ____

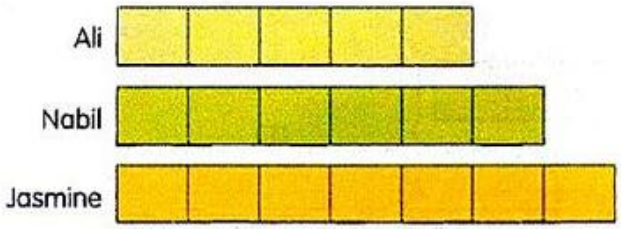
The length of the blue ribbon is ____ of the total length of the two ribbons.

$\frac{\text{Length of the pink ribbon}}{\text{Total length of the two ribbons}} =$ ____

The length of the pink ribbon is ____ of the total length of the two ribbons.

TRY 1c

The ratio of Ali's height to Nabil's height to Jasmine's height is 5 : 6 : 7.



(a) Ali's height is ____ of Nabil's height.

(b) Jasmine's height is ____ of Ali's height.

(c) Total height of the three children = ____ + ____ + ____

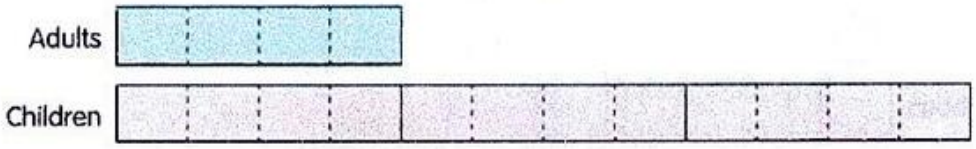
= ____ units

The ratio of Nabil's height to the total height of the three children in its simplest form is ____ : ____.

Nabil's height is ____ of the total height of the three children.

LEARN

There are 4 adults and 12 children watching a play.



The ratio of the number of adults to the number of children is 4 : 12 = 1 : 3.

$$\frac{\text{Number of adults}}{\text{Number of children}} = \frac{4}{12} = \frac{1}{3}$$

The number of adults is $\frac{1}{3}$ of the number of children.

The ratio of the number of children to the number of adults is 3 : 1.

$$\frac{\text{Number of children}}{\text{Number of adults}} = \frac{3}{1}$$

The number of children is $\frac{3}{1}$ of the number of adults.

So, the number of children is 3 **times** the number of adults.

TRY 2

Hafiz spent \$18 and Bowen spent \$36. Express your answer in its simplest form.

(a) The ratio of the amount of money Hafiz spent to the amount of money Bowen spent is ____ : ____ = ____ : ____.

(b) $\frac{\text{Amount of money Hafiz spent}}{\text{Amount of money Bowen spent}} =$ ____

$=$ ____

The amount of money Hafiz spent is ____ of the amount of money Bowen spent.

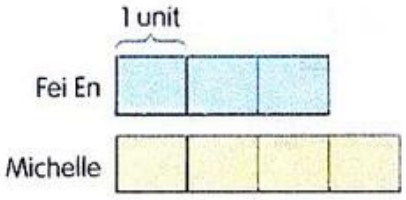
(c) $\frac{\text{Amount of money Bowen spent}}{\text{Amount of money Hafiz spent}} =$ ____

$=$ ____

The amount of money Bowen spent is ____ times the amount of money Hafiz spent.

LEARN

Fei En saves $\frac{3}{4}$ as much money as Michelle.



We can draw a model using 3 units to represent Fei En's savings and 4 units to represent Michelle's savings.

The ratio of Michelle's savings to Fei En's savings is 4 : 3.

The ratio of Fei En's savings to Michelle's savings is 3 : 4.

Their total savings is 4 + 3 = 7 units.

The ratio of Michelle's savings to their total savings is 4 : 7.

Michelle's savings is $\frac{4}{7}$ of their total savings.

LEARN

Ratios and Fractions

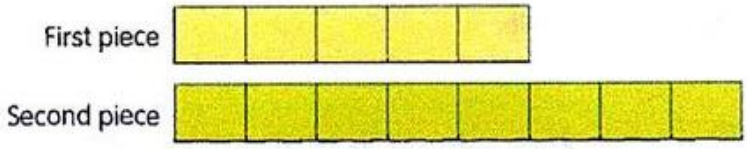
Use models, ratios and fractions to compare quantities.

Work in groups.

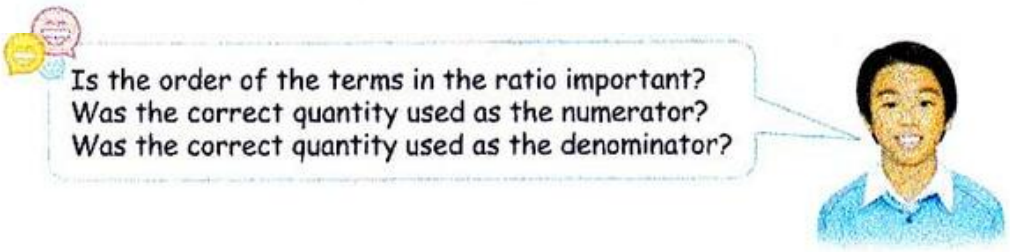
1. Use to show the statement: The number of 🟦 is $\frac{3}{8}$ of the number of 🟥.
2. Draw a model to represent the statement in 1.
3. Rewrite the fraction as a ratio.
4. Switch roles. Repeat 1 to 3 with the following statements.
   - a. The number of 🟦 is $\frac{7}{5}$ of the number of 🟨.
   - b. The number of 🟩 is $\frac{9}{14}$ of the total number of 🟥 and 🟩.

TRY

3. Ryan cuts a piece of rope into two pieces. The length of the first piece is $\frac{5}{8}$ of the length of the second piece.

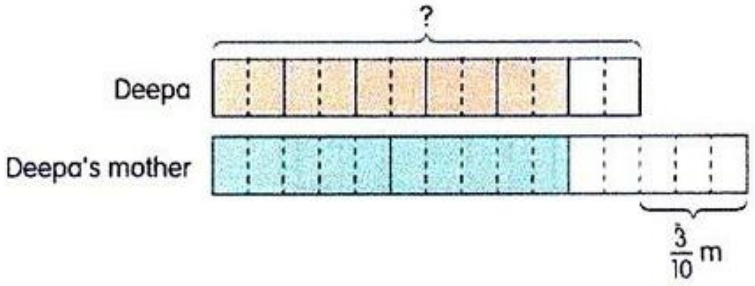


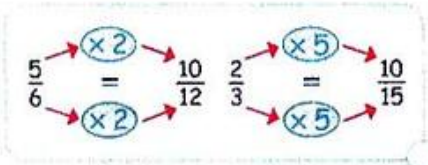
   - a. The ratio of the length of the second piece to the length of the first piece is ____ : ____.
   - b. The total length of the rope is ____ + ____ = ____ units.
   - c. The ratio of the length of the second piece to the total length of the rope is ____ : ____.
   - d. The length of the second piece is ____ of the total length of the rope.


Is the order of the terms in the ratio important?
Was the correct quantity used as the numerator?
Was the correct quantity used as the denominator?

LEARN

$\frac{5}{6}$ of Deepa's height is equal to $\frac{2}{3}$ of her mother's height. The difference in their heights is $\frac{3}{10}$ m. What is Deepa's height? Express your answer as a mixed number in its simplest form.





3 units $= \frac{3}{10}$

1 unit $= \frac{3}{10} \div 3$

$= \frac{{}^{1}\cancel{3}}{10} \times \frac{1}{\cancel{3}_{1}}$

$= \frac{1}{10}$

12 units $= \frac{1}{{}_{5}\cancel{10}} \times \cancel{12}^{6}$

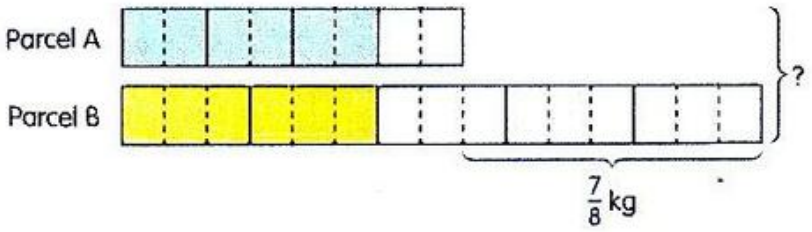
$= \frac{6}{5}$

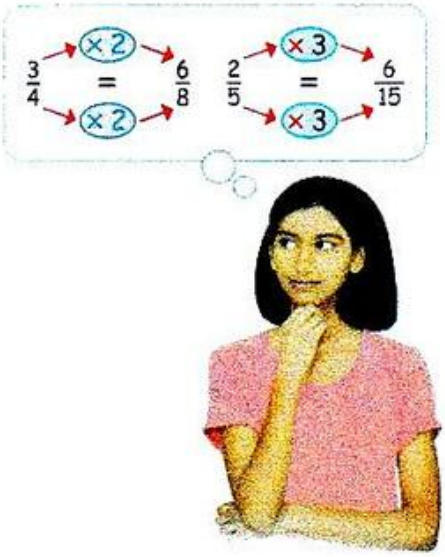
$= 1\frac{1}{5}$

Deepa's height is $1\frac{1}{5}$ m.

TRY 4

$\frac{3}{4}$ of the mass of Parcel A is equal to $\frac{2}{5}$ of the mass of Parcel B. Parcel A is $\frac{7}{8}$ kg lighter than Parcel B. Find the total mass of both parcels. Express your answer as a mixed number in its simplest form.





[ ] units = [ ]

1 unit = [ ] ÷ [ ]

= [ ]

[ ] units = [ ] × [ ]

= [ ]

The total mass of both parcels is [ ] kg.

Workbook A: Practice 1, pages 55–62

Lesson 2 Comparing Ratios

Finding the ratio of two quantities

Before you learn ...

Amil exchanged a $1 coin for a few 20-cent coins.

Cheng Wei exchanged two $1 coins for some 20-cent coins.

Sharlene exchanged five $1 coins for a number of 20-cent coins.

For each person, use to find the ratio of the number of $1 coins exchanged to the number of 20-cent coins. Express your answer in its simplest form. What do you observe?

LEARN 1

The table shows the different amounts of tea and milk used to make cups of milk tea of different cup sizes.

Cup Size	A	B	C	D	E
Amount of Tea (ml)	180	270	360	450	540
Amount of Milk (ml)	60	90	120	150	180

The ratio of the amount of tea used to the amount of milk used for each cup size is as shown.

Cup Size	A	B	C	D	E
Tea : Milk	180 : 60	270 : 90	360 : 120	450 : 150	540 : 180
Tea : Milk (Simplest Form)	3 : 1	3 : 1	3 : 1	3 : 1	3 : 1

What can you say about the ratios?

The ratio of the amount of tea used to the amount of milk used is the **same** for each cup size.

We can also say that the ratio of the amount of tea used to the amount of milk used is 3 : 1.

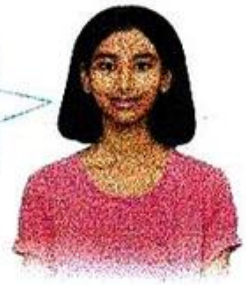
TRY 1

Mr Poon uses the following table to prepare four different mixtures of cement and sand using identical pails. Complete the table.

Number of Pails of Cement	4	8	12	16
Number of Pails of Sand	3	6	9	12
Cement : Sand	4 : 3	8 : 6	▭ : ▭	▭ : ▭
Cement : Sand (Simplest Form)	4 : 3	4 : 3	▭ : ▭	▭ : ▭
$\frac{\text{Number of Pails of Cement}}{\text{Number of Pails of Sand}}$	$\frac{4}{3}$	$\frac{4}{3}$	▭	▭

Are the units the same?

From the table, what do you notice about the ratios and fractions? What can you conclude?



LEARN 2

To make one portion of dough, Suzy mixes 5 cups of flour with every 3 cups of water.

(a) Find the ratio of the amount of flour used to the amount of water used to make 1 portion of the dough.

(b) Suzy wants to make 5 portions of the dough. How many cups of flour and how many cups of water does she need?

(c) She uses 21 cups of water to make the same type of dough. How many cups of flour does she need?

(c) Amount of flour : Amount of water = 5 : 3
The ratio of the amount of flour used to the amount of water used to make the dough is 5 : 3.

(d) $\frac{\text{Amount of flour}}{\text{Amount of water}} = \frac{5}{3} = \frac{25}{15}$ (×5 above, ×5 below)

Amount of flour : Amount of water
5 : 3
(×5) 25 : 15 (×5)

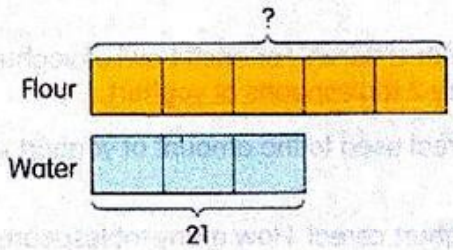
She needs 25 cups of flour and 15 cups of water.

(e) **Method 1**

$\frac{\text{Amount of flour}}{\text{Amount of water}} = \frac{5}{3} = \frac{35}{21}$ (×7 above, ×7 below)

(×7) $\frac{5}{3} = \frac{?}{21}$ (×7)

Method 2



3 units = 21
1 unit = 21 ÷ 3
= 7
5 units = 7 × 5
= 35

She needs 35 cups of flour.

LEARN

Hands-On Activity

Use ratio to find quantities.

Work in pairs.

1. A gingerbread man recipe makes 12 cookies. Use the following recipe to find the ratio of the amount of flour needed to the amount of brown sugar needed.

Ingredients
300 g flour
5 g bicarbonate soda
10 g ground ginger
2.5 g ground cinnamon
2.5 g ground nutmeg
125 g unsalted butter
100 g brown sugar
45 g golden syrup

2. Your partner uses the ratio in 1 to find the amounts of flour and brown sugar needed to make 48 cookies.

3. Switch roles. Repeat 1 and 2 with the following.
   a. Find the amount of ground ginger and ground cinnamon needed to make 6 cookies.
   b. Find the amount of flour and golden syrup needed to make 72 cookies.

TRY

2A Mrs Raj makes some yoghurt cereal for her children. For each bowl of yoghurt cereal, she uses 3 tablespoons of cereal for every 2 tablespoons of yoghurt.

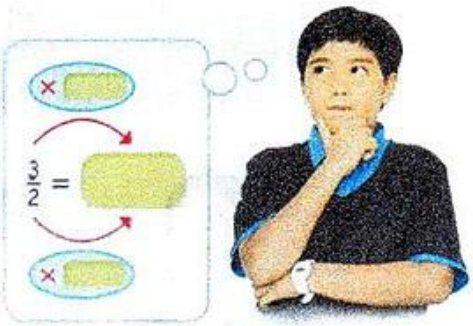
a. Find the ratio of the amount of cereal used to the amount of yoghurt used to make the yoghurt cereal.
b. She wants to make 4 bowls of yoghurt cereal. How many tablespoons of cereal and how many tablespoons of yoghurt does she need?
c. She uses 24 tablespoons of cereal. How many tablespoons of yoghurt does she need?

(a) Amount of cereal : Amount of yoghurt = [ ] : [ ]

The ratio of the amount of cereal used to the amount of yoghurt used to make the yoghurt cereal is [ ] : [ ].

(b) $\frac{\text{Amount of cereal}}{\text{Amount of yoghurt}} = \frac{3}{2}$

$= $ [ ]

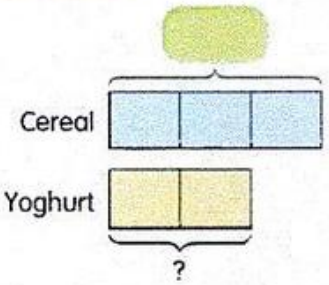


She needs [ ] tablespoons of cereal and [ ] tablespoons of yoghurt.

(c) **Method 1**

$\frac{\text{Amount of cereal}}{\text{Amount of yoghurt}} = \frac{3}{2} =$ [ ]

Method 2



3 units = [ ]

1 unit = [ ] ÷ [ ]

= [ ]

[ ] units = [ ] × [ ]

= [ ]

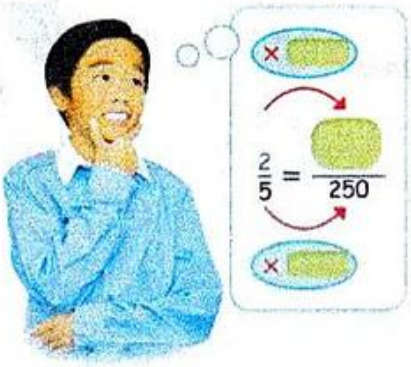
She needs [ ] tablespoons of yoghurt.

TRY 28

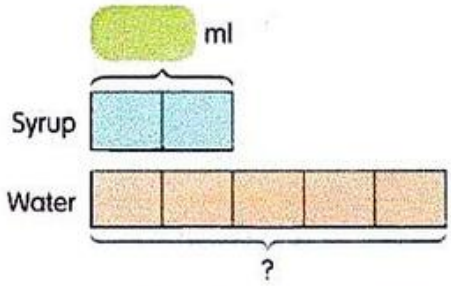
Wayne mixed syrup and water in the ratio 2 : 5 to make a drink for a party.

(a) Find the missing numbers in the table.

Amount of Syrup (ml)		200	600		1400
Amount of Water (ml)	250	500		2500	



(b) Wayne used 800 ml of syrup. How much water did he use?



2 units =

1 unit = ÷

=

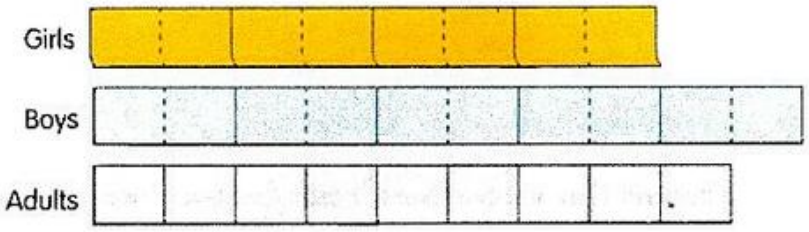
5 units = ×

=

He used ml of water.

LEARN 3

The ratio of the number of girls to the number of boys at a concert is 4 : 5. The ratio of the number of boys to the number of adults is 10 : 9. Find the ratio of the number of girls to the number of boys to the number of adults at the concert in its simplest form.



Number of girls	:	Number of boys	:	Number of adults
4	:	5		
(×2) ↓		10	(×2)	: 9
8	:	10	:	9

The ratio of the number of girls to the number of boys to the number of adults at the concert in its simplest form is 8 : 10 : 9.

TRY 3

The ratio of the area of Triangle A to the area of Triangle B is 7 : 11. The ratio of the area of Triangle A to the area of Triangle C is 21 : 40. Find the ratio of the area of Triangle A to the area of Triangle B to the area of Triangle C in its simplest form.

Area of Triangle A	:	Area of Triangle B	:	Area of Triangle C
7	:	11		
(×) ↓			(×)	
21	:		:	40

The ratio of the area of Triangle A to the area of Triangle B to the area of Triangle C in its simplest form is ____ : ____ : ____.

Workbook A: Practice 2, pages 63–66

Lesson 3

Solving Word Problems

Solving word problems

Before you learn ...

The number of cards Mariana had was $\frac{8}{5}$ of the number of cards Ben had. They had 26 cards altogether. Find the ratio of the number of cards Ben had to the total number of cards they had. Use to show how many cards Ben had.

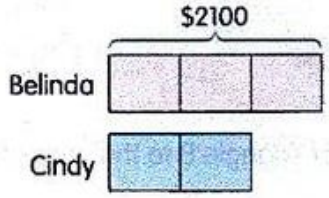
LEARN

Belinda's salary is $\frac{3}{2}$ of Cindy's salary. Belinda earns \$2100. How much do they earn altogether?

Step 1 What have I gathered from the problem?

Step 2 How do I solve it?
I can draw a model.

Step 3 What do I need to find?
I need to find the ratio of Belinda's salary to Cindy's salary.
Then, I need to find their total salaries.

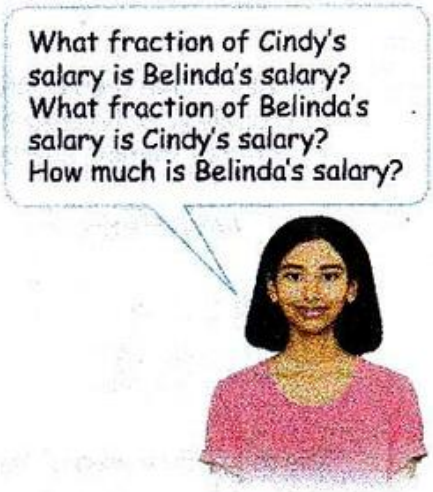


Total number of units = 3 + 2
= 5

3 units = \$2100
1 unit = \$2100 ÷ 3
= \$700
5 units = \$700 × 5
= \$3500

They earn \$3500 altogether.

Step 4 How can I check my answer?
I can work backwards to check my answer.


What fraction of Cindy's salary is Belinda's salary?
What fraction of Belinda's salary is Cindy's salary?
How much is Belinda's salary?

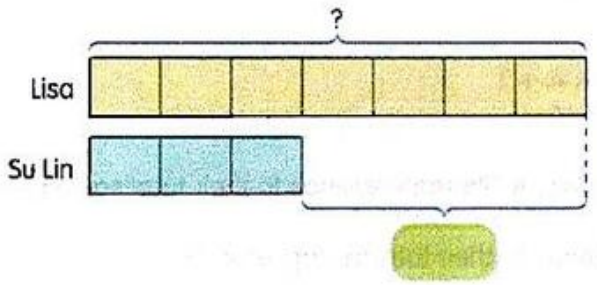
TRY 1

The number of stickers Lisa has is $\frac{7}{3}$ of the number of stickers Su Lin has.

Lisa has 172 more stickers than Su Lin.

(a) Find the ratio of the number of stickers Su Lin has to the number of stickers Lisa has to the total number of stickers they have.

(b) How many stickers do they have altogether?



(a) Total number of units = [ ] + [ ]

= [ ]

The ratio of the number of stickers Su Lin has to the number of stickers Lisa has to the total number of stickers they have is [ ] : [ ] : [ ].

(b) 4 units = [ ]

1 unit = [ ] ÷ [ ]

= [ ]

[ ] units = [ ] × [ ]

= [ ]

They have [ ] stickers altogether.

LEARN

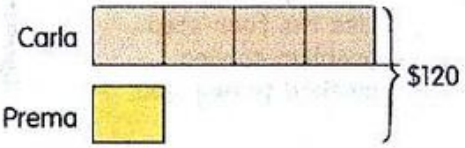
Carla's savings is 4 times as much as Prema's savings. Both girls save a total of $120.

(a) What is the ratio of Carla's savings to Prema's savings to their total savings?

(b) What fraction of their total savings is Carla's savings?

(c) What fraction of Carla's savings is Prema's savings?

(d) How much does Carla save?



(a) Total number of units $= 4 + 1$
$= 5$

The ratio of Carla's savings to Prema's savings to their total savings is 4 : 1 : 5.

(b) The ratio of Carla's savings to their total savings is 4 : 5.

Carla's savings is $\frac{4}{5}$ of their total savings.

(c) The ratio of Prema's savings to Carla's savings is 1 : 4.

Prema's savings is $\frac{1}{4}$ of Carla's savings.

(d) 5 units = $120
1 unit = $120 ÷ 5
= $24
4 units = $24 × 4
= $96

Carla saves $96.

The ratio of Carla's savings to their total savings is 4 : 5.
Carla's savings is $\frac{4}{5}$ of their total savings.
Carla's savings $= \frac{4}{5} \times \$120$
$= \$96$

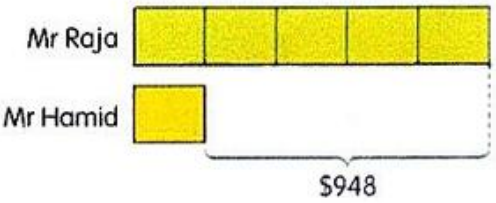
TRY

2 Mr Raja spent 5 times as much money as Mr Hamid. Mr Raja spent $948 more than Mr Hamid.

(a) What is the ratio of the amount of money Mr Raja spent to the amount of money Mr Hamid spent to the total amount of money they spent?

(b) What fraction of the total amount of money they spent is the amount of money Mr Raja spent?

(c) How much did Mr Raja and Mr Hamid each spend?



(a) The ratio of the amount of money Mr Raja spent to the amount of money Mr Hamid spent to the total amount of money they spent is

[ ] : [ ] : [ ].

(b) $\frac{\text{Amount Mr Raja spent}}{\text{Total amount they spent}} =$ [ ]

The amount of money Mr Raja spent is [ ] of the total amount of money they spent.

(c) [ ] units = $[ ]

[ ] unit = $[ ] ÷ [ ]

= $[ ]

[ ] units = $[ ] × [ ]

= $[ ]

Mr Raja spent $[ ] and Mr Hamid spent $[ ].

LEARN 3

The ratio of Gina's score to Ken's score in a bowling game is 3 : 2. The ratio of Ken's score to Wen Xin's score is 4 : 5. Gina, Ken and Wen Xin score 360 points altogether.

(a) Find the ratio of Gina's score to Wen Xin's score.

(b) How many points does Wen Xin score?

(a)

Gina's score	:	Ken's score	:	Wen Xin's score
3 (×2) → 6	:	2 (×2) → 4	:	
	:	4	:	5

The ratio of Gina's score to Wen Xin's score is 6 : 5.

(b)

Method 1

Total number of units = 6 + 4 + 5
= 15

15 units = 360
1 unit = 360 ÷ 15
= 24
5 units = 24 × 5
= 120

Wen Xin scores 120 points.

Method 2

Wen Xin's score	:	Total score
5 (÷5) → 1	:	15 (÷5) → 3

Wen Xin's score = $\frac{1}{3} \times 360$
= 120

TRY 3

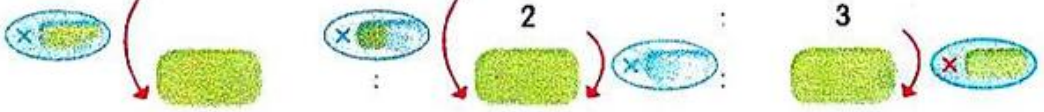
Ani, Betty and Jaya keep fish as pets. The ratio of the number of fish Ani has to the number of fish Betty has is 5 : 3. The ratio of the number of fish Betty has to the number of fish Jaya has is 2 : 3.

(a) Find the ratio of the number of fish Ani has to the number of fish Betty has to the number of fish Jaya has.

(b) They have a total of 175 fish. How many fish do Ani and Betty have altogether?

(a) Number of fish Ani has : Number of fish Betty has : Number of fish Jaya has

5 : 3 : 2 : 3



The ratio of the number of fish Ani has to the number of fish Betty has to the number of fish Jaya has is ____ : ____ : ____.

(b) Method 1

Total number of units = ____ + ____ + ____

= ____

Number of units Ani and Betty have altogether = ____ + ____

= ____

____ units = ____

1 unit = ____ ÷ ____

= ____

____ units = ____ × ____

= ____

Method 2

Number of fish Ani has : Total number of fish

10 : 25

Number of fish Ani has = ____ × 175

= ____

Number of fish Betty has = ____ × 175

= ____

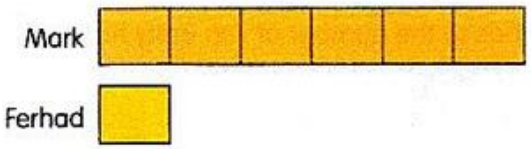
____ + ____ = ____

Ani and Betty have ____ fish altogether.

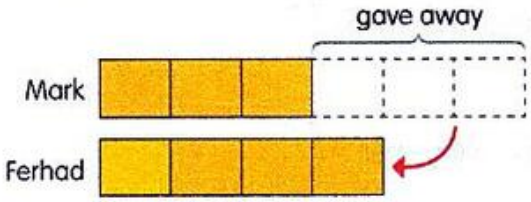
LEARN 4

Mark and Ferhad had some money in the ratio 6 : 1. Mark gave half of his money to Ferhad. Find the ratio of the amount of money Mark had to the amount of money Ferhad had in the end.

Before



After

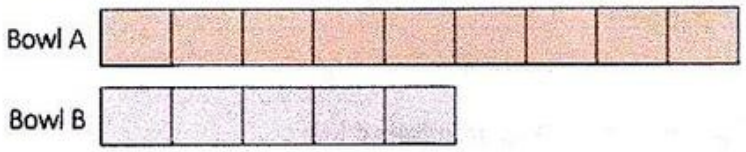


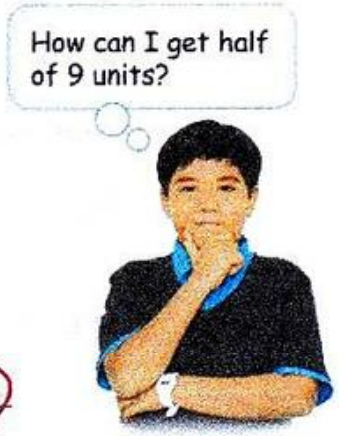
The ratio of the amount of money Mark had to the amount of money Ferhad had in the end was 3 : 4.

TRY 4

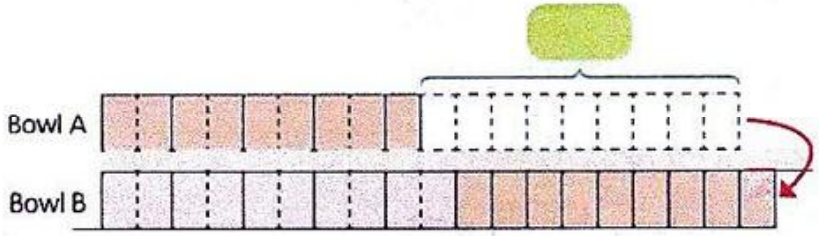
Mrs Lim pours some cereal into two bowls. The ratio of the mass of cereal in Bowl A to the mass of cereal in Bowl B is 9 : 5. She transfers half of the cereal from Bowl A to Bowl B. What is the new ratio of the mass of cereal in Bowl A to the mass of cereal in Bowl B?

Before





After



The new ratio of the mass of cereal in Bowl A to the mass of cereal in Bowl B is ____ : ____.

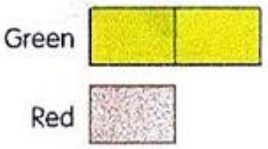
LEARN

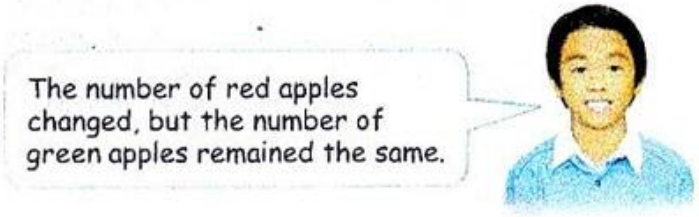
Trina placed some green and red apples in a basket. The ratio of the number of green apples to the number of red apples was 2 : 1. She placed 12 more red apples in the basket and the ratio of the number of green apples to the number of red apples became 4 : 5.

a) How many green apples were there in the basket?

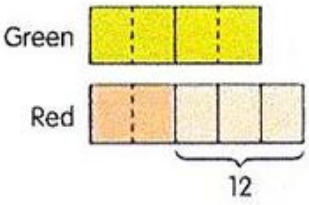
b) How many red apples did Trina have in the end?

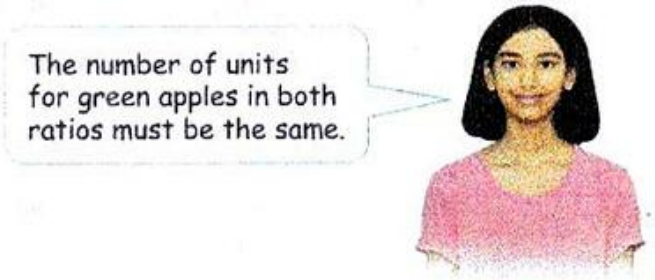
Before





After





a) 3 units = 12
1 unit = 12 ÷ 3
= 4
4 units = 4 × 4
= 16

There were 16 green apples in the basket.

b) 5 units = 4 × 5
= 20

Trina had 20 red apples in the end.

LEARN

Kimberly and Marcus had some money each. The ratio of the amount of money Kimberly had to the amount of money Marcus had was 4 : 3. Kimberly then gave $48 to Marcus. The ratio of the amount of money Kimberly had to the amount of money Marcus had became 2 : 3.

(a) How much did Kimberly have at first?

(b) How much did Marcus have in the end?

The amount of money Kimberly and Marcus each had changed. However, the total amount of money they had remained unchanged. So, the total number of units in both situations must be equal.

Before

Kimberly	:	Marcus	Total number of units
4 (×5) → 20	:	3 (×5) → 15	7 (×5) → 35

After

Kimberly	:	Marcus	Total number of units
2 (×7) → 14	:	3 (×7) → 21	5 (×7) → 35

(c) After Kimberly gave Marcus $48, Kimberly's units decreased from 20 units to 14 units.

Difference in the number of units = 20 − 14
= 6

6 units = $48
1 unit = $48 ÷ 6
= $8
20 units = $8 × 20
= $160

Kimberly had $160 at first.

(d) 21 units = $8 × 21
= $168

Marcus had $168 in the end.

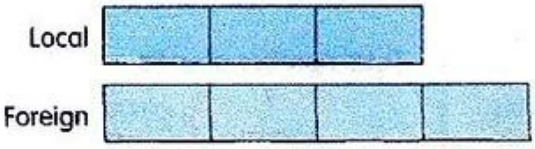
TRY 5A

Nadeem had some local and foreign stamps. The ratio of the number of local stamps to the number of foreign stamps was 3 : 4. She gave away 28 foreign stamps and the ratio of the number of local stamps to the number of foreign stamps became 9 : 8.

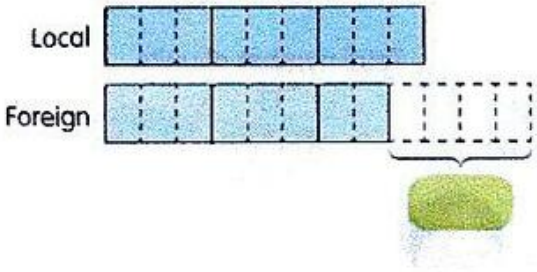
(a) How many local stamps did Nadeem have?

(b) How many foreign stamps did Nadeem have in the end?

Before



After



(a) 4 units =

1 unit = ÷

=

units = ×

=

Nadeem had local stamps.

(b) units = ×

=

Nadeem had foreign stamps in the end.

TRY 5B

Huizhen and Lathi made some paper cranes. The ratio of the number of paper cranes Huizhen made to the number of paper cranes Lathi made was 5 : 2. Huizhen gave Lathi 46 paper cranes. The ratio of the number of paper cranes Huizhen had to the number of paper cranes Lathi had became 6 : 7.

(a) How many paper cranes did Huizhen have at first?

(b) How many paper cranes did they make altogether?

Before

Huizhen	:	Lathi	Total number of units
5	:	2	7
	:		

After

Huizhen	:	Lathi	Total number of units
6	:	7	13
	:		

(a) Difference in the number of units

= ____ − ____

= ____

23 units = ____

1 unit = ____ ÷ ____

= ____

____ units = ____ × ____

= ____

Huizhen had ____ paper cranes at first.

(b) ____ units = ____ × ____

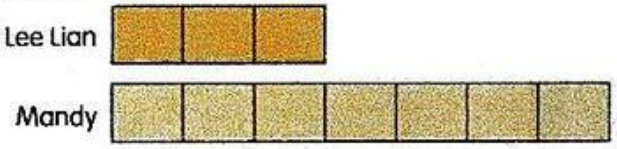
= ____

They made ____ paper cranes altogether.

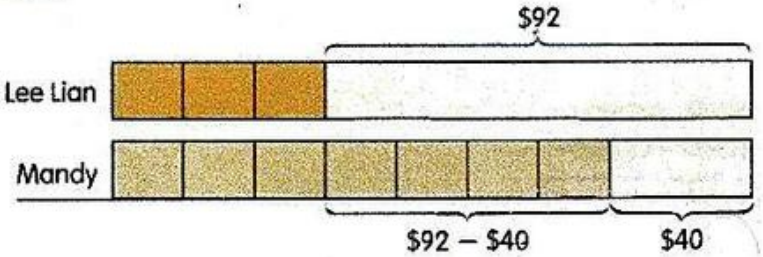
LEARN

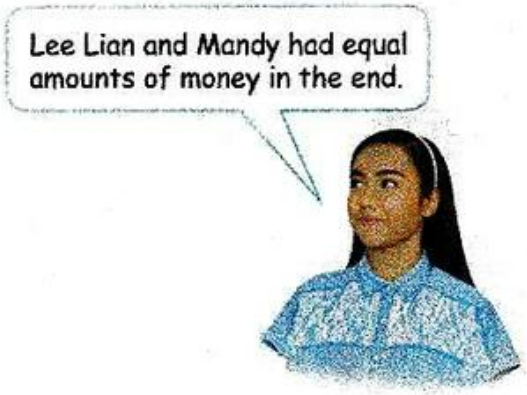
Lee Lian and Mandy had some money in the ratio 3 : 7. After Lee Lian received $92 and Mandy received $40, both girls had an equal amount of money. How much money did each girl have at first?

Before



After





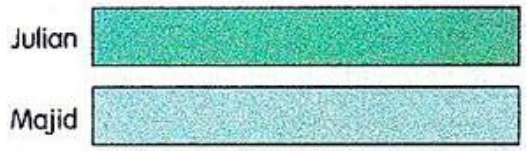
4 units = $92 − $40
= $52
1 unit = $52 ÷ 4
= $13
3 units = $13 × 3
= $39
7 units = $13 × 7
= $91

Lee Lian had $39 and Mandy had $91 at first.

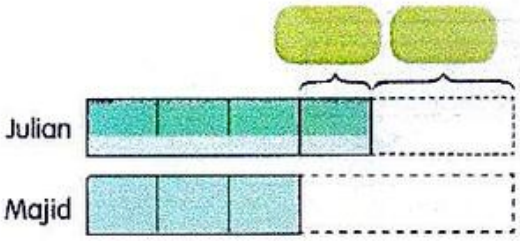
TRY 6

Julian and Majid had the same number of rubber bands at first. Julian gave away 12 rubber bands and Majid gave away 20 rubber bands. The ratio of the number of rubber bands Julian had left to the number of rubber bands Majid had left became 4 : 3. How many rubber bands did each boy have at first?

Before



After



What changed?
What remained unchanged?

1 unit = ☐

4 units = ☐ × ☐

= ☐

Julian had ☐ rubber bands in the end.

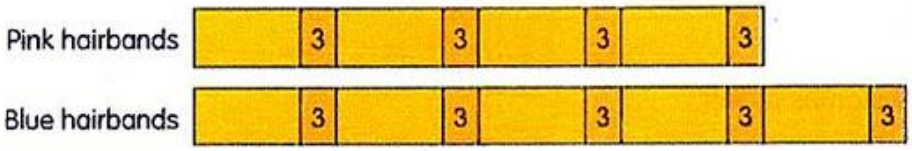
☐ + ☐ = ☐

Each boy had ☐ rubber bands at first.

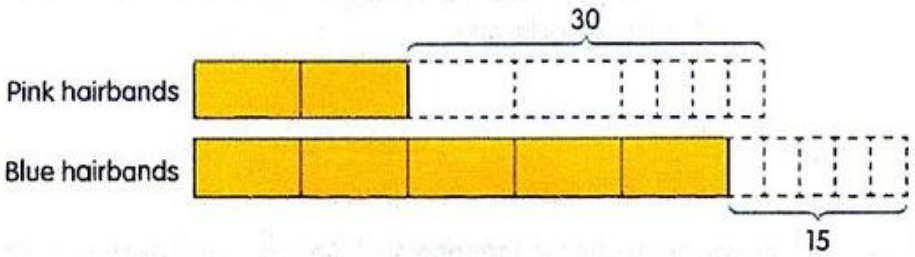
LEARN

Wendy had some blue and pink hairbands. The number of blue hairbands was $\frac{5}{4}$ of the number of pink hairbands. She gave away 30 pink hairbands and 15 blue hairbands. After that, the number of pink hairbands became $\frac{2}{5}$ of the number of blue hairbands. How many pink hairbands did Wendy have in the end?

Before

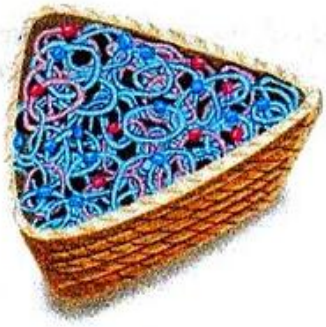


After



2 units = 30 − (3 × 4)
= 18

Wendy had 18 pink hairbands in the end.



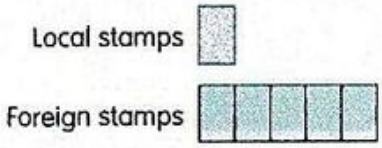
LEARN

Bobby had some local and foreign stamps. The number of local stamps was $\frac{1}{5}$ the number of foreign stamps. Bobby bought 15 more stamps of each type. The number of foreign stamps became $\frac{5}{3}$ of the number of local stamps in the end. How many stamps did Bobby have at first?

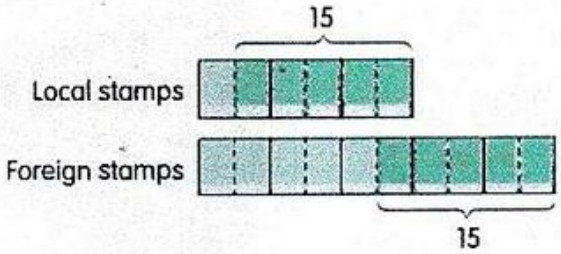
Before

Local stamps

Foreign stamps



After



5 units = 15
1 unit = 15 ÷ 5
= 3
6 units = 3 × 6
= 18

Bobby had 18 stamps at first.

LEARN

Hands-On Activity Use equivalent ratios and the before-after concept to solve problems involving changing ratios.

Work in pairs.

1. Read the word problem.

Example

Raymond and Amrita shared some files in the ratio 5 : 7. Amrita gave Raymond 6 files. The ratio of the number of files Raymond had to the number of files Amrita had became 2 : 1. How many files were there altogether?

2. Solve the problem. Discuss your solution with your partner.

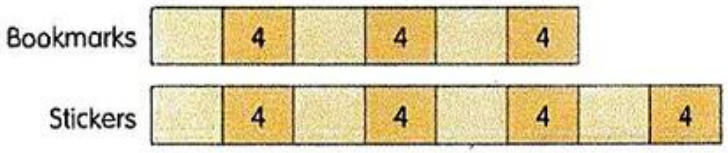
3. Repeat 1 and 2 with this problem.

Matt and Dwayne shared a sum of money equally. After Dwayne used $12, the ratio of the amount of money Matt had to the amount of money Dwayne had became 5 : 3. How much money did Dwayne have at first?

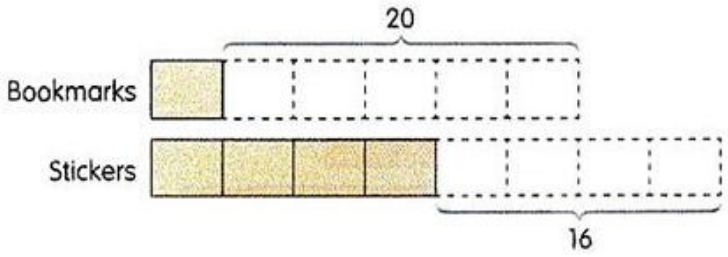
TRY 7A

The number of stickers that Rajesh had was $\frac{4}{3}$ of the number of bookmarks. He misplaced 20 bookmarks and 16 stickers. After that, the number of bookmarks became $\frac{1}{4}$ of the number of stickers. How many bookmarks did Rajesh have in the end?

Before



After



[ ] units = [ ] − ([ ] × [ ])

= [ ]

[ ] unit = [ ] ÷ [ ]

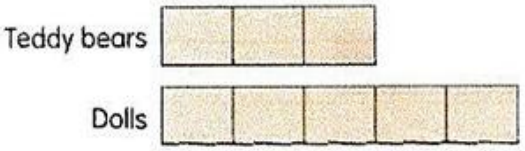
= [ ]

Rajesh had [ ] bookmarks in the end.

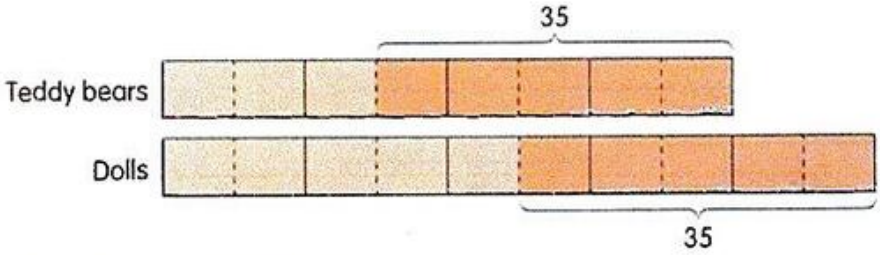
TRY 78

Felicity had some teddy bears and dolls. The number of teddy bears was $\frac{3}{5}$ of the number of dolls. She bought 35 more of each type of toy. After that, the number of teddy bears was $\frac{4}{5}$ of the number of dolls. How many teddy bears and dolls did Felicity have altogether at first?

Before



After



[ ] units = [ ]

1 unit = [ ] ÷ [ ]

= [ ]

[ ] units = [ ] × [ ]

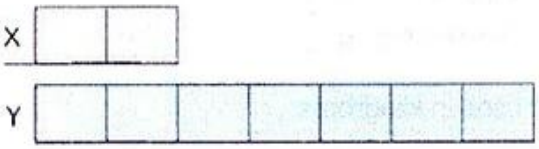
= [ ]

Felicity had [ ] teddy bears and dolls altogether at first.

Workbook A: Practice 3, pages 67–76

Chapter 3 Review

1. X represents 2 units of stamps and Y represents 7 units of stamps.

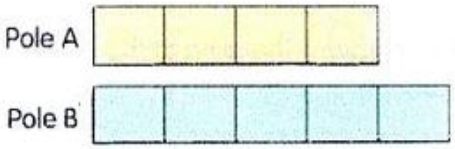


   a. Find the ratio of X to Y.

   b. X is _____ of Y.

   c. Y is _____ of X.

2. The ratio of the length of Pole A to the length of Pole B is 4 : 5.



   a. Find the ratio of the length of Pole A to the total length of the two poles.

   b. What fraction of the length of Pole A is the length of Pole B?

   c. What fraction of the length of Pole B is the length of Pole A?

   d. What fraction of the total length of the two poles is the length of Pole A?

   e. What fraction of the total length of the two poles is the length of Pole B?

3. Mr Lim mixes 4 pails of blue paint and 5 pails of yellow paint to make a container of green paint.

   a. Find the ratio of the number of pails of yellow paint used to the number of pails of blue paint used to make a container of green paint.

   b. Mr Lim uses a total of 63 pails of blue and yellow paint. How many pails of blue paint does he use?

   c. How many containers of green paint can Mr Lim get if he uses 12 pails of blue paint and 15 pails of yellow paint?

4 Mrs Muthu used 125 g of butter, 200 g of chocolate chips, 125 g of caster sugar and 225 g of crushed pretzels to make a bag of candy. Mrs Muthu made 75 bags of candy to sell at a charity sale.

a Find the ratio of the mass of butter used to the mass of chocolate chips used to the mass of caster sugar used in its simplest form.

b Find the total mass of caster sugar used in kilograms.

5 The mass of potatoes used by Mrs Wee in her cooking was $\frac{5}{2}$ of the mass of carrots used. She used 9 kg more potatoes than carrots.

a Find the ratio of the mass of potatoes used to the mass of carrots used to the total mass of the ingredients used.

b Find the total mass of the ingredients.

6 A wall with an area of 4 m^2 was painted yellow and brown. The area of the wall painted yellow was 3 times as large as the area painted brown.

a What was the ratio of the area painted yellow to the area painted brown?

b What fraction of the total area of the wall was painted brown?

c Find the area of the wall painted yellow.

7 The ratio of the volume of water in Jug A to the volume of water in Jug B is 2 : 5.

a Half of the water in Jug A is poured into Jug B. What is the new ratio of the volume of water in Jug A to Jug B?

b Half of the water in Jug B is poured into Jug A. What is the new ratio of the volume of water in Jug A to Jug B?

c $\frac{1}{3}$ of the water in Jug A is poured into Jug B. What is the new ratio of the volume of water in Jug A to Jug B?

8 The ratio of the amount of money Karen had to the amount of money Peter had was 2 : 5. After Peter received $75 from his mother, the ratio of the amount of money Karen had to the amount of money Peter had became 4 : 15. How much money did each person have at first?

9 The ratio of the number of coins Azam had to the number of coins Eddie had was 3 : 7. Eddie gave 42 coins to Azam and they ended up having the same number of coins. How many coins did each person have at first?

10 There were 3 identical glasses each containing the same amount of juice. Mr Lee poured 210 ml of juice from Glass A into Glass C, and 150 ml of juice from Glass B into Glass C. In the end, the amount of juice in Glass A was $\frac{3}{8}$ of the amount of juice in Glass B.

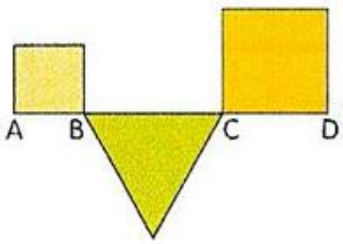
(a) How much juice was there in Glass A at the end?

(b) How much juice was there in each glass at first?

11 Colin had some red chilli and green chilli. The mass of red chilli is $\frac{6}{5}$ of the mass of green chilli. He used 60 g of red chilli and 15 g of green chilli. He then had twice as much green chilli as red chilli. How many grams of red chilli did Colin have in the end?

LOOK BACK 12 P5 Ratio

The figure is made up of two different squares and an equilateral triangle. The ratio of the length of AB to the length of BC to the length of CD is 2 : 4 : 3. AD = 108 cm. Find the total perimeter of the figure.



Workbook A:
Chapter 3 Review, pages 77–83
Maths Journal, page 84

Chapter Wrap-Up

Ratio

Ratio and Fraction

- The numerator of the fraction refers to the first quantity of the ratio and the denominator refers to the second quantity of the ratio.

Example

Green beads

Blue beads

The ratio of the number of green beads to the number of blue beads is 4 : 7.

The number of green beads is $\frac{4}{7}$ of the number of blue beads.

- Ratios and fractions can be used to show that one quantity is a multiple of another.

Example
Matt is 3 times as heavy as his son. So, the ratio of Matt's mass to his son's mass is 3 : 1.

Comparing Ratios

- When one quantity is a multiple of another quantity, this means that the quantities increase or decrease by the same multiple.

Example
At a school canteen, each child gets 2 servings of vegetables for every 1 serving of meat, while each adult gets 4 servings of vegetables for every 2 servings of meat.

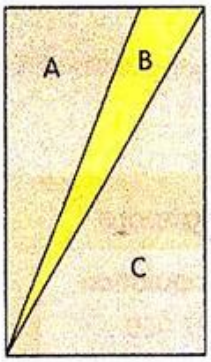
Solving Word Problems

You may want to revisit the following topic:

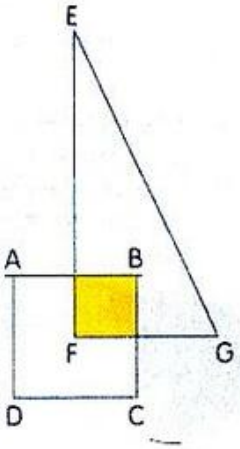
- P5 Ratio

Put On Your Thinking Cap!

1. The rectangle is divided into three parts, A, B and C. The ratio of Area A to Area B is 3 : 2. What fraction of Area C is Area A?



2. The figure is made up of a square, ABCD, and a triangle, EFG. The area of Square ABCD is $\frac{2}{3}$ of the area of Triangle EFG. $\frac{1}{4}$ of Square ABCD is shaded. The total area of the unshaded parts is 72 cm^2. What is the length of a side of Square ABCD?

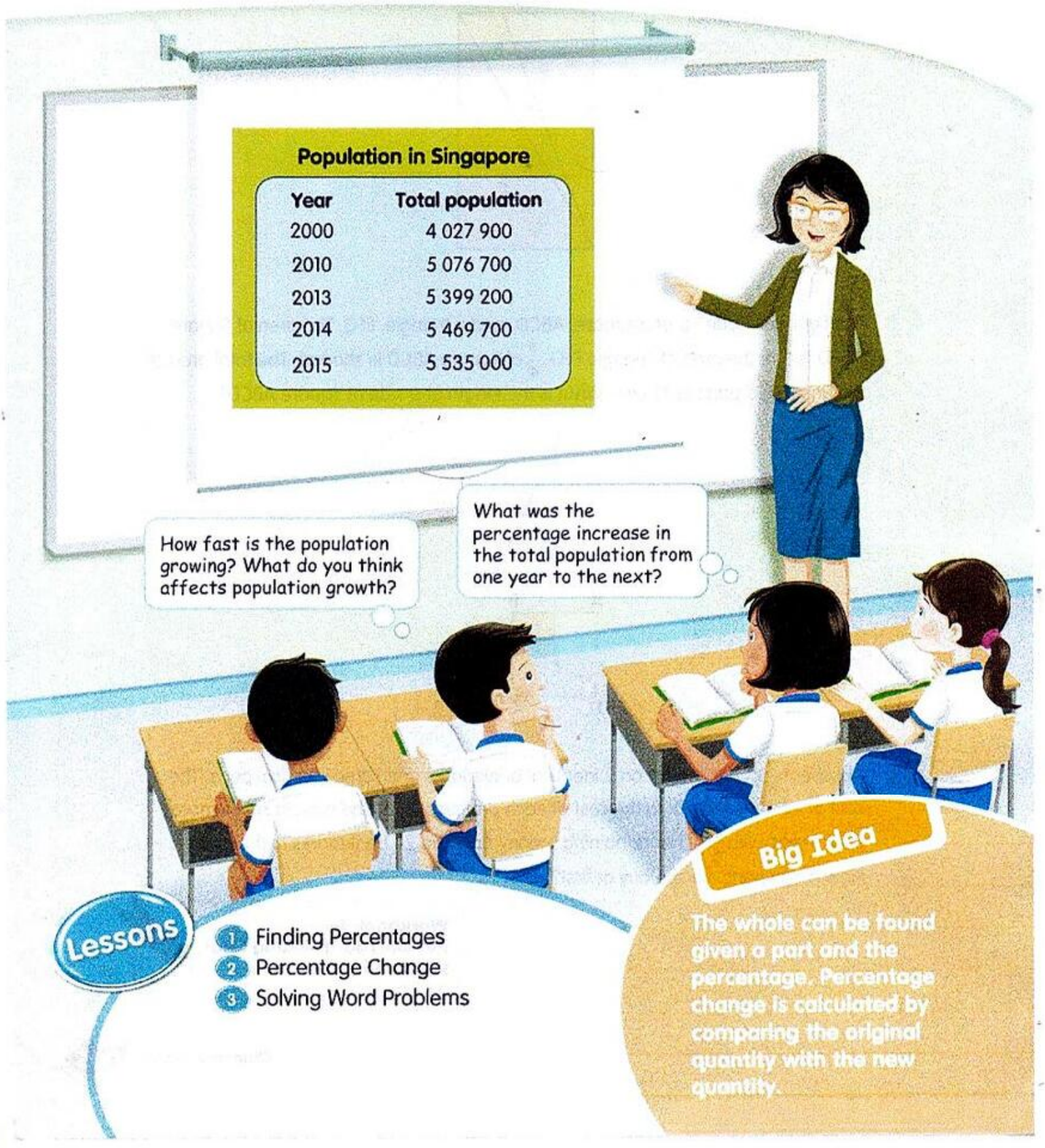


3. Abi spent $\frac{1}{6}$ of her money on 2 identical bookmarks and some identical pens. The cost of each bookmark to the cost of each pen was 2 : 3. She bought some more bookmarks with $\frac{2}{5}$ of her remaining money and had 24 bookmarks in the end. How many pens did she buy at first?

Workbook A:
Put On Your Thinking Cap!, pages 85–86

CHAPTER 4

Percentage


Population in Singapore
Year | Total population
2000 | 4 027 900
2010 | 5 076 700
2013 | 5 399 200
2014 | 5 469 700
2015 | 5 535 000
How fast is the population growing? What do you think affects population growth?
What was the percentage increase in the total population from one year to the next?

Lessons

1. Finding Percentages
2. Percentage Change
3. Solving Word Problems

Big Idea

The whole can be found given a part and the percentage. Percentage change is calculated by comparing the original quantity with the new quantity.

Lesson 1 Finding Percentages

Recall

The table shows the number of 4-room and 5-room flats in a block of flats.

Type of Flat	Number
4-room	33
5-room	27

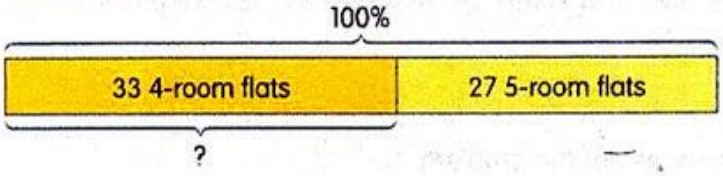
What percentage of the flats in the block are 4-room flats?

Method 1

Total number of flats = 33 + 27
= 60

Percentage of flats in the block that are 4-room flats
$= \frac{33}{60} \times 100\%$
$= 55\%$

Method 2



60 flats → 100%
1 flat → 100% ÷ 60
$= 1\frac{2}{3}\%$
33 flats → $1\frac{2}{3}\% \times 33$
$= 55\%$

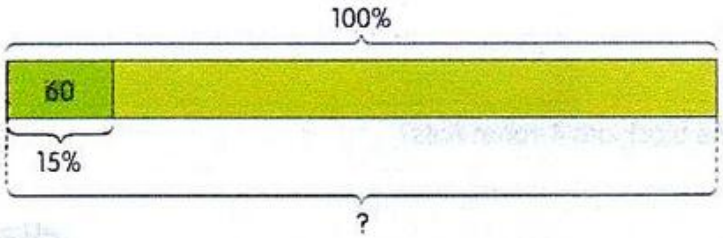
55% of the flats in the block are 4-room flats.

Before you learn ...

Lionel thinks of a number. 25% of the number is 78. Draw a model to represent the number that Lionel is thinking of. Explain.

LEARN

There were 60 people who wore T-shirts at a workshop. The number of people who wore T-shirts was 15% of the total number of people. How many people were there at the workshop altogether?



15% of the people = 60
1% of the people = 60 ÷ 15
= 4
100% of the people = 4 × 100
= 400

There were 400 people at the workshop altogether.

LEARN

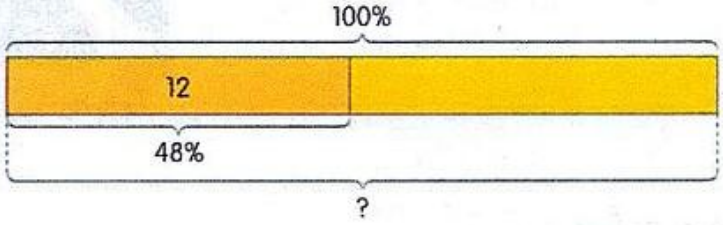
Hands-On Activity Use models to represent a percentage part of a quantity and find the quantity.

Work in pairs.

1. Read the word problem. Draw a model for the problem.

Example

Velma places 48% of her hair clips in a box. There are 12 hair clips in the box. How many hair clips does Velma have altogether?



2. Use the model to solve the problem.

3. Your partner checks your answer using a calculator.

4. Repeat 1 to 3 with these problems.

   a. 75% of a number is 708. Find the number.

   b. At an amusement park, 60% of the people were adults and the rest were children. There were 720 adults. How many people were at the amusement park?

   c. The cost of a book with 7% GST is $24.61. How much does the book cost without GST?

TRY 1A

20% of a number is 184. What is the number?

[ ] % of the number = [ ]

[ ] % of the number = [ ] ÷ [ ]

= [ ]

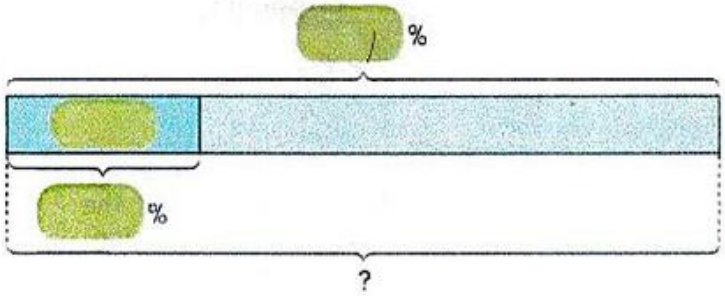
[ ] % of the number = [ ] × 100

= [ ]

The number is [ ].

TRY 1B

27% of the pupils in a school are in Primary Six. There are 540 Primary Six pupils. How many pupils are there in the school?



27% → [ ]

1% → [ ] ÷ [ ]

= [ ]

100% → [ ] × 100

= [ ]

There are [ ] pupils in the school.

Workbook A: Practice 1, pages 87–90

Lesson 2

Percentage Change

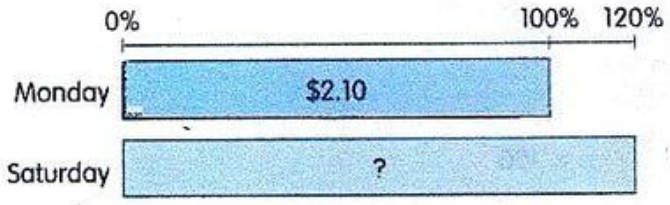
Finding percentage increase or decrease

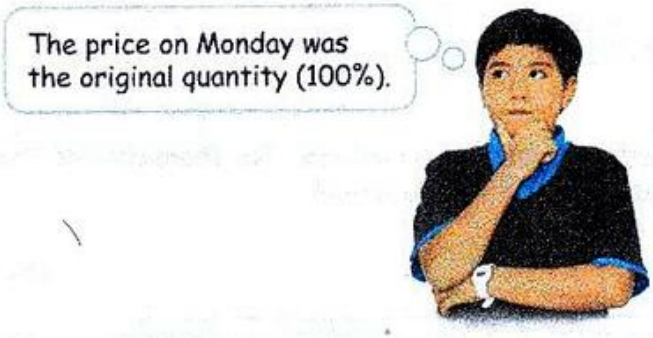
Before you learn ...

The usual price of a watch was $100. Myra bought it during a sale at a discount of 20%. How much was the discount? How much did the watch cost after the discount? Draw a model to help you.

LEARN

Mr Ismail paid $2.10 per litre of petrol at a petrol kiosk on Monday. On Saturday, he topped up his fuel tank with the same type of petrol but its price per litre had increased by 20%. What was the price per litre of petrol on Saturday?

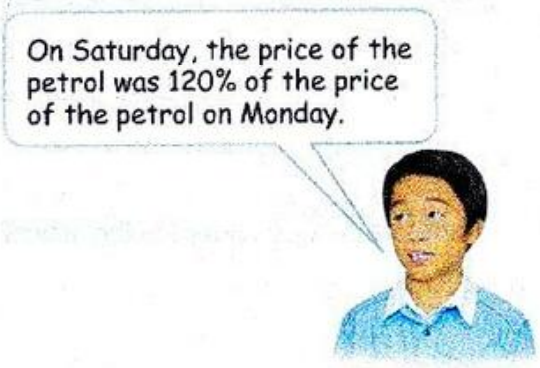




Method 1

100% + 20% = 120%

100% → $2.10
1% → $2.10 ÷ 100
= $0.021
120% → $0.021 × 120
= $2.52



Method 2

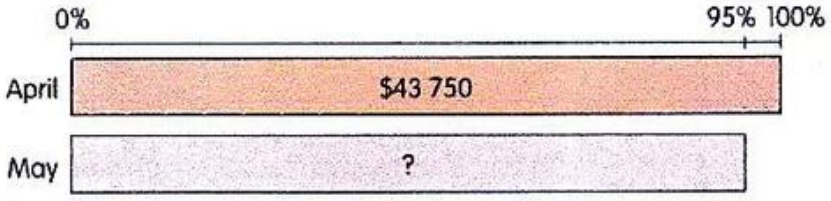
$20\% \text{ of } \$2.10 = \frac{20}{100} \times \$2.10$
$= \$0.42$

$\$2.10 + \$0.42 = \$2.52$

The price per litre of petrol on Saturday was $2.52.

LEARN

The price of a new car was $43 750 in April. The price of the car decreased by 5% in May. Find the price of the car in May.



$100\% - 5\% = 95\%$

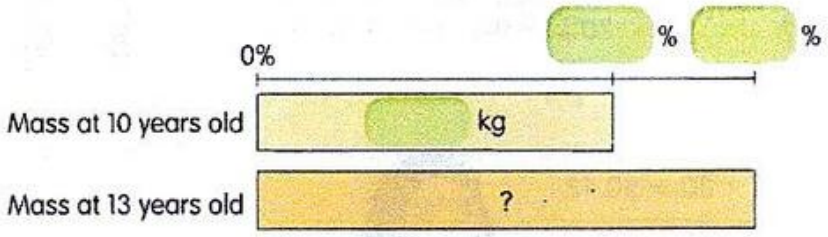
The price of the car in May was 95% of the price of the car in April.

$95\% \text{ of } \$43\,750 = 95\% \times \$43\,750$
$= \$41\,562.50$

The price of the car in May was $41 562.50.

TRY 14

When Donald was 10 years old, his mass was 32 kg. When he was 13 years old, his mass increased by 40%. Find Donald's mass when he was 13 years old.



Method 1

100% + ☐% = ☐%

His mass at 13 years old was ☐% of his mass at 10 years old.

100% → ☐

1% → ☐ ÷ 100

= ☐

140% → ☐ × ☐

= ☐

What percentage does 32 kg represent?

Method 2

40% of 32 kg = $\frac{\square}{100}$ × ☐

= ☐ kg

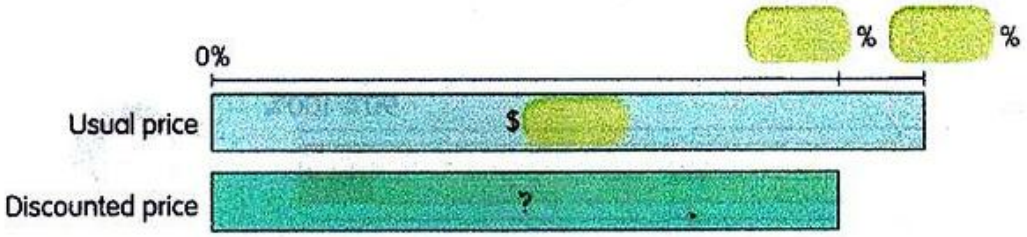
32 + 12.8 = ☐

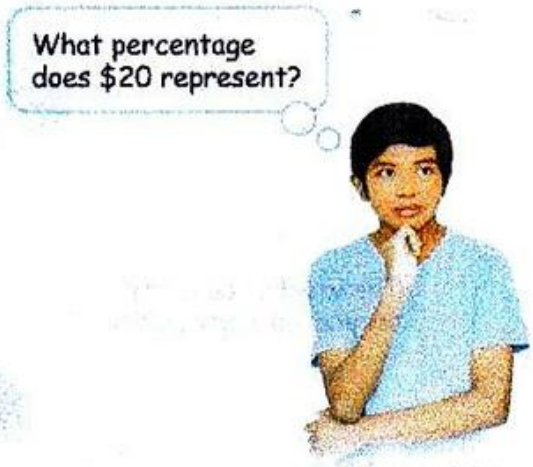
40% → ☐ × ☐ = ☐

Donald's mass was ☐ kg when he was 13 years old.

TRY 18

The usual price for a ticket to the two conservatories at Gardens by the Bay is $20. Yi Xuan buys one ticket at a discount of 12%. How much does she pay for the discounted ticket?





100% − % = %

The discounted price is % of the usual price.

% of $ = % × $

= $

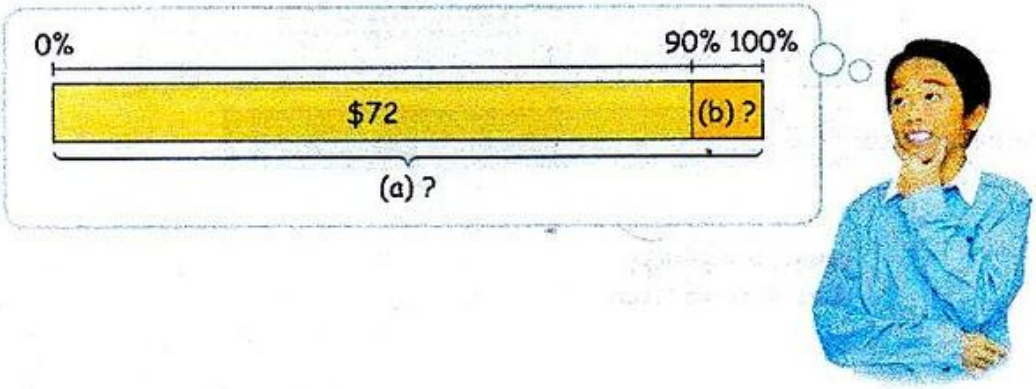
She pays $ for the discounted ticket.

LEARN

Janice bought a watch at a discount. She paid \$72 for it. This was 90% of the usual price.

(a) What was the usual price of the watch?

(b) How much was the discount?



(a) 90% → \$72

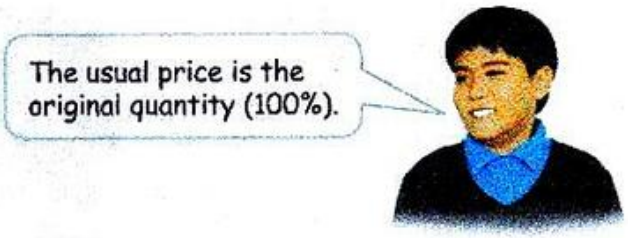
1% → \$72 ÷ 90

= \$0.80

100% → \$0.80 × 100

= \$80

The usual price of the watch was \$80.



10% → \$0.80 × 10

= \$8

\$72 + \$8 = \$80

(b) \$80 − \$72 = \$8

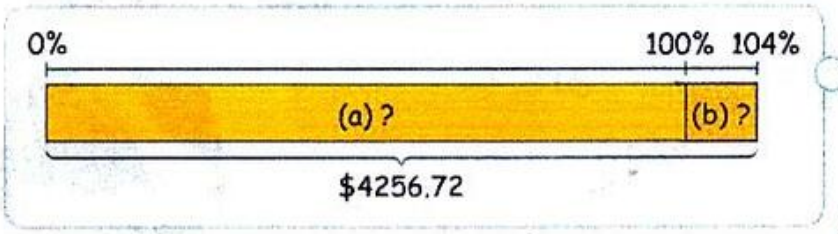
The discount was \$8.

LEARN

Rufus deposited some money in a fixed deposit account at the beginning of the year. The bank paid 4% interest at the end of each year. The amount of money in his account then increased to $4256.72 at the end of the year.

(a) How much did Rufus deposit in the account at the beginning of the year?

(b) How much interest did he earn at the end of the year?



(a) 100% + 4% = 104%
104% → $4256.72
1% → $4256.72 ÷ 104
= $40.93
100% → $40.93 × 100
= $4093

Rufus deposited $4093 in the account at the beginning of the year.

(b) 4% → $40.93 × 4
= $163.72

He earned $163.72 interest at the end of the year.

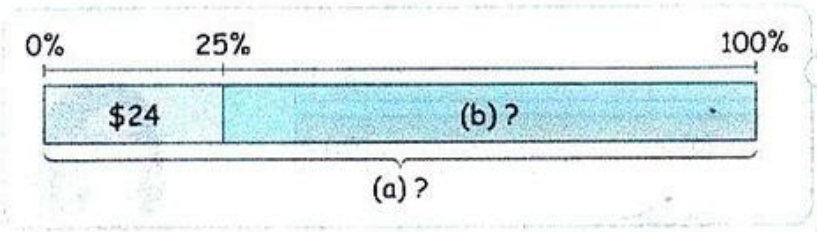
Check:
Amount deposited + Interest = Amount at the end of the year
$4093 + $163.72 = $4256.72

TRY 24

May paid $24 for a bag during a sale. The amount paid by May was 25% of the price of the bag before the discount.

(a) What was the price of the bag before the discount?

(b) What was the discount given for the bag?



(a) [ ] % → $24

1% → [ ] ÷ [ ]

= [ ]

100% → [ ] × 100

= [ ]

The price of the bag before the discount was [ ].

(b) 100% − [ ] % = [ ] %

[ ] % → [ ] × [ ]

= [ ]

The discount given for the bag was [ ].

TRY 25

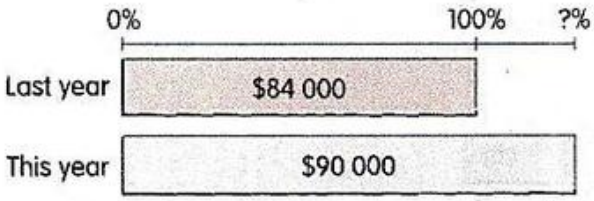
The price of a mobile phone with 7% GST is $620.60.

(a) Find its price without GST. [ ]

(b) How much was the GST? [ ]

LEARN

The price of a particular model of car was $84 000 last year. This year, the price of the same model of the car became $90 000. Find the percentage increase in the price of the car, correct to 1 decimal place.



Increase in price = $90 000 − $84 000
= $6000

Percentage increase = $\frac{\$6000}{\$84\,000} \times 100\%$
≈ 7.1%

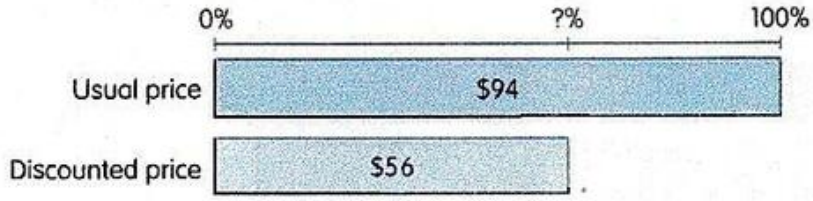
The percentage increase in the price was 7.1%.

We are comparing last year's price with the price this year. So, we take $84 000 as the original quantity (100%).

$$\text{Percentage change} = \frac{\text{Change}}{\text{Original quantity}} \times 100\%$$

LEARN

The usual price of a fishing rod was $94. Mr See sold the rod to Mr Ramly for $56. Find the percentage discount. Give your answer correct to the nearest whole number.



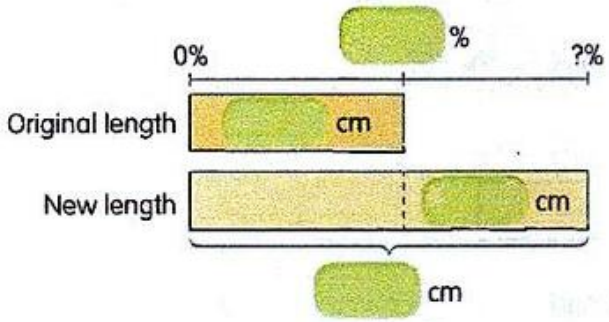
Discount = $94 − $56
= $38

Percentage discount = $\frac{38}{94} \times 100\%$
= 40% (correct to the nearest whole number)

The percentage discount was 40%.

TRY 3A

The original length of a spring was 4 cm. It was stretched to a length of 7.5 cm. What was the percentage increase in its length?



Increase in length = 7.5 −

= cm

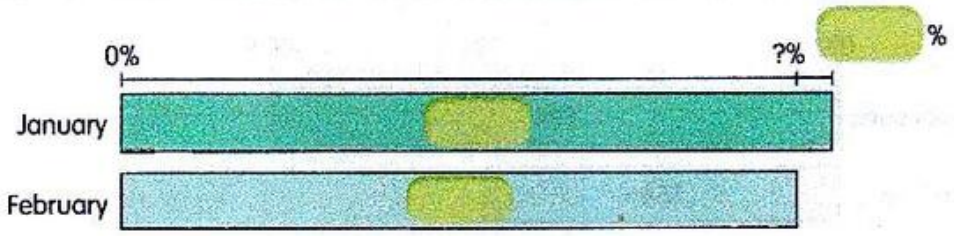
Percentage increase = × 100%

= %

The percentage increase in its length was %.

TRY 3B

The number of visitors to Singapore in January was 1 412 000. The number of visitors in February was 1 334 900. Find the percentage decrease in the number of visitors from January to February. Give your answer correct to the nearest whole number.



Decrease = 1 412 000 −

=

Percentage decrease = × 100%

≈ %

The percentage decrease in the number of visitors was %.

LEARN

There were 150 members in a club last year. 30 new members joined the club this year. Find the percentage increase in the membership of the club.

$\frac{30}{150} \times 100\% = 20\%$

There was a 20% increase in the membership of the club.

TRY 4

The usual price of a necklace was \$399. Miss Low paid \$59.85 less for the necklace after a discount. What was the percentage discount given to Miss Low?

[ ] × 100% = [ ] %

The percentage discount given to Miss Low was [ ] %.

LEARN 5

Nora's bean plant grew 5 cm since she measured it a week ago. The increase was 8% of the bean plant's height a week ago. How tall is Nora's plant now?

8% → 5
1% → 5 ÷ 8
= 0.625
108% → 0.625 × 108
= 67.5

Nora's plant is 67.5 cm tall now.

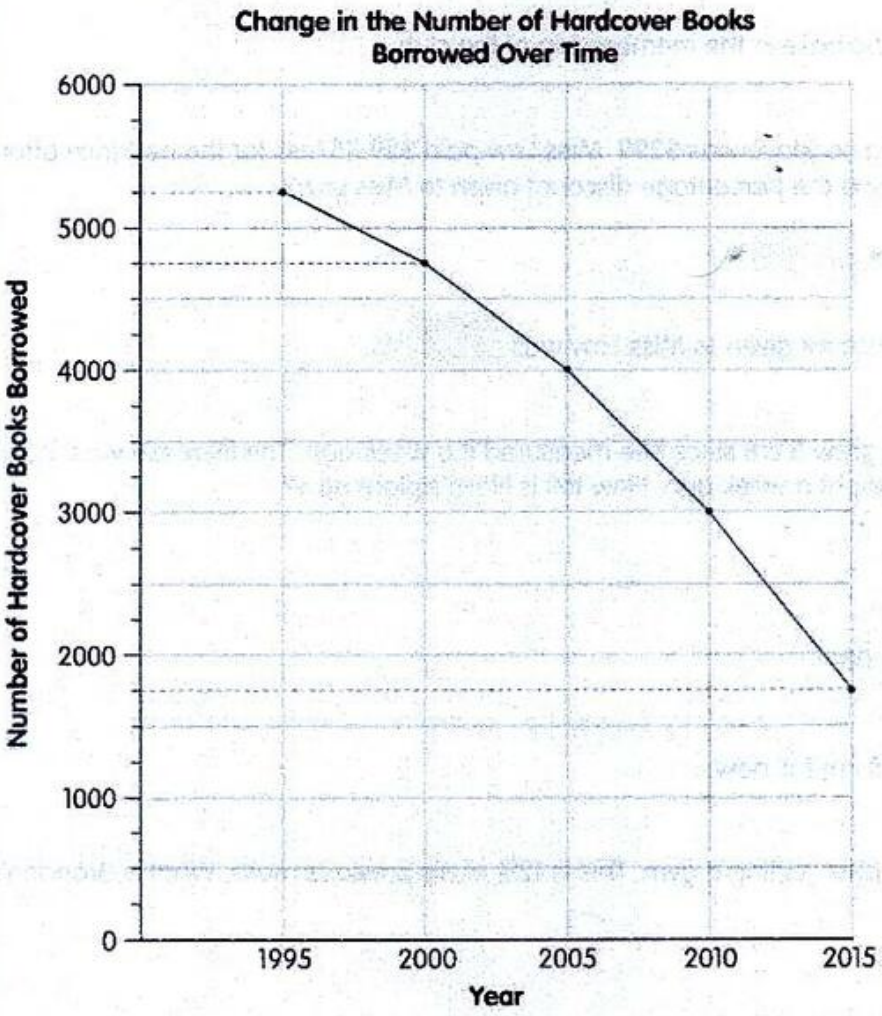
TRY 5

Brandon lost 9 kg after joining a gym. This is 12% of his previous mass. What is Brandon's mass now?

12% → [ ]
1% → [ ] ÷ [ ]
= [ ]
88% → [ ] × [ ]
= [ ]

Brandon's mass now is [ ] kg.

The line graph shows the change in the number of hardcover books that were borrowed from a library over the years.



Discuss with your classmates the possible factors that caused the above change. Can we use a formula or equation to calculate the percentage decrease in the number of hardcover books borrowed from the library? Explain.

LEARN

Hands-On Activity

Use a calculator to find percentage change.

Play in groups of four.

1. Roll a twice. If the same number is rolled twice, you lose a turn.
2. Use a calculator to calculate the difference between the first number and the second number and express the difference as a percentage of the first number, correct to the nearest whole number.

   Example
   1st roll: 5
   2nd roll: 3

   Difference $= 5 - 3$
   $= 2$ (decrease)

   Percentage change $= \frac{2}{5} \times 100\%$
   $= 40\%$ decrease
3. The other players will check your answer. Each player receives 1 point for finding the correct difference and 1 point for finding the correct percentage change.
4. Each player will take turns to roll the .
5. The game ends when a player in the group receives 10 points.

Maths Sharing

Find real-life examples of percentage change.

Find real-life examples of percentage increase or decrease in newspapers, magazines, promotional flyers and websites. Discuss with your classmates how percentage changes are calculated.

Workbook A: Practice 2, pages 91–100

Lesson 3

Solving Word Problems

Solving word problems involving percentage

Before you learn ...

Gwen's height was 140 cm when she was 10 years old. She was 161 cm tall when she was 12 years old. Draw a model to find the percentage increase in Gwen's height.

LEARN

Shaun collected $925 on the first day of a funfair. On the second day, he collected $728. By the third day, he had collected a total of $2538.

(a) What was the percentage decrease in the amount of money collected from the first day to the second day? Give your answer correct to 1 decimal place.

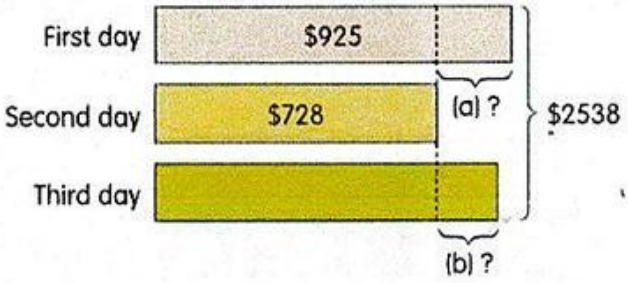
(b) Find the percentage change in the amount collected from the second day to the third day. Give your answer correct to 1 decimal place.

What have I gathered from the problem?

How much did Shaun collect on the third day?
What is the difference in the amount of money collected from the first day to the second day?
What is the difference in the amount of money collected from the second day to the third day?

How do I solve it?
I can draw a model.

Step 2 What do I need to find?
I need to find the amount of money Shaun collected on the third day, the difference in the amount of money collected from the first day to the second day and the difference in the amount of money collected from the second day to the third day.



Step 3 Decrease in the amount of money collected from the first day to the second day
= $925 − $728
= $197

Percentage decrease = $\frac{197}{925} \times 100\%$
= 21.3% (correct to 1 decimal place)

The percentage decrease in the amount of money collected from the first day to the second day was 21.3%.

Step 4 Amount of money collected on the third day = $2538 − $925 − $728
= $885

Increase in the amount of money collected from the second day to the third day
= $885 − $728
= $157

Percentage increase = $\frac{157}{728} \times 100\%$
= 21.6% (correct to 1 decimal place)

The percentage increase in the amount of money collected from the second day to the third day was 21.6%.

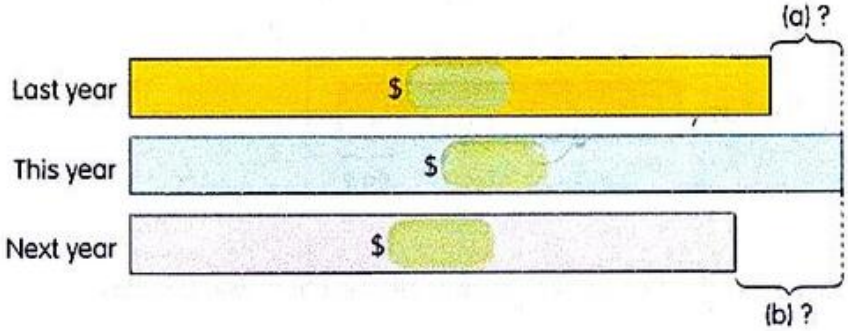
Step 5 How can I check my answer?
I can work backwards to check if my answer is reasonable.

TRY 1

The price of a set of hardcover storybooks last year was $104. This year, the price of storybooks increased to $114.40. Next year, the price of the storybooks will drop to $97.24.

(a) Find the percentage increase in the price of the storybooks from last year to this year.

(b) Find the percentage change in the price of the storybooks from this year to next year.



(a) Increase in the price of the storybooks from last year to this year

= $ [ ] − $ [ ]

= $ [ ]

Percentage increase = [ ] × 100%

= [ ] %

The percentage increase in the price of the storybooks from last year to this year was [ ] %.

(b) [ ] in the price of the storybooks from this year to next year

= $ [ ] − $ [ ]

= $ [ ]

Percentage [ ] = [ ] × 100%

= [ ] %

The percentage [ ] in the price of the storybooks from this year to next year will be [ ] %.

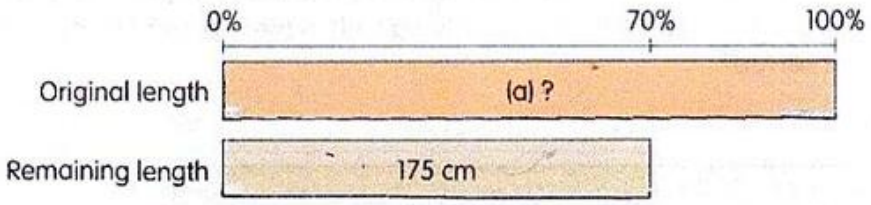
LEARN

Mr Wee had a strip of leather. He cut 30% of the strip of leather to make a belt. The remaining length of the strip of leather was 175 cm. He then cut off 25% of the remaining strip of leather to make a bracelet.

a) What was the original length of the strip of leather?

b) What was the length of the remaining strip of leather in the end?

a)



$100\% - 30\% = 70\%$

The remaining length is 70% of the original length.

The original length was the original quantity (100%).

$70\% \rightarrow 175$

$1\% \rightarrow 175 \div 70$

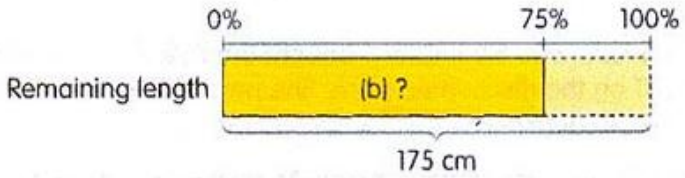
$= 2.5$

$100\% \rightarrow 2.5 \times 100$

$= 250$

The original length of the strip of leather was 250 cm.

b)



$100\% - 25\% = 75\%$

The remaining length is 75% of the original length.

Here, the original quantity is the length of the strip of leather **after** making the belt (100%).

75% of $175 \text{ cm} = \frac{75}{100} \times 175$

$= 131.25 \text{ cm}$

The length of the remaining strip of leather in the end was 131.25 cm.

LEARN

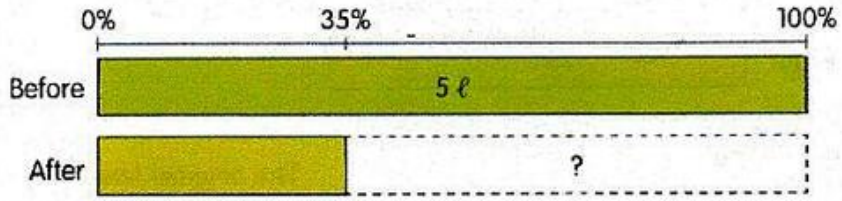
Hands-On Activity Use the before-after concept to illustrate percentage increase or decrease.

Work in pairs.

1. Read the word problem. Draw a model for the problem.

Example

There were 5 ℓ of fruit punch in a jug. Some fruit punch was poured out and served to guests at a party. 35% of the fruit punch was left in the jug. How many litres of fruit punch were served?



2. Use the model to solve the problem.
3. Your partner checks your answer using a calculator.
4. Repeat 1 to 3 with these problems.

   a. Clive ran 12 km over one weekend. The distance he ran increased by 40% the following weekend. How far did he run the following weekend?

   b. A drop of paint covered an area of 4 cm^2. A few minutes later, the area covered by paint became 7.5 cm^2. What was the percentage increase in the area covered by paint?

   c. The usual price of a flute was \$125. Cheryl bought the flute at a discount. There was a 7% GST on the discounted price. She paid \$107 for the flute. How much was the discount?

   d. A new restaurant opened with 20 employees. As business improved a month later, the number of employees increased by 25%. After a year of opening, it cut down its number of employees to 22 to reduce costs.

      i. How many employees did the restaurant have at the end of the month?

      ii. Find the percentage decrease in the number of employees from the end of the first month to the end of the first year.

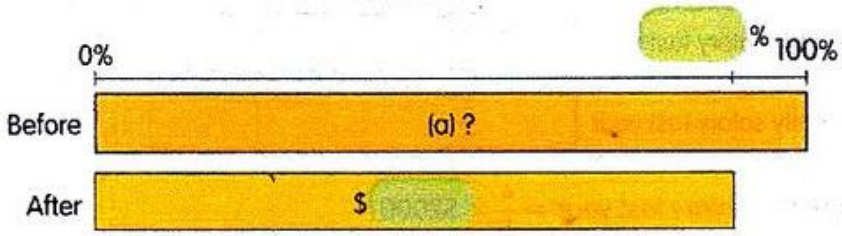
TRY 2

Joe's savings decreased by 10% to $360. A week later, his savings decreased further by 20%.

(a) What was Joe's savings at first?

(b) What was Joe's savings in the end?

(a)



100% − [ ]% = [ ]%

[ ]% of his savings = $[ ]

1% of his savings = [ ] ÷ [ ]

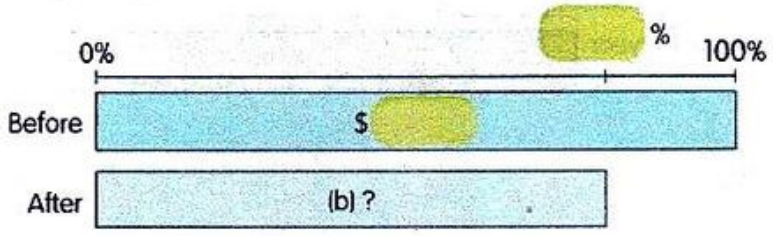
= [ ]

100% of his savings = [ ] × [ ]

= [ ]

Joe's savings at first was [ ].

(b)



100% − [ ]% = [ ]%

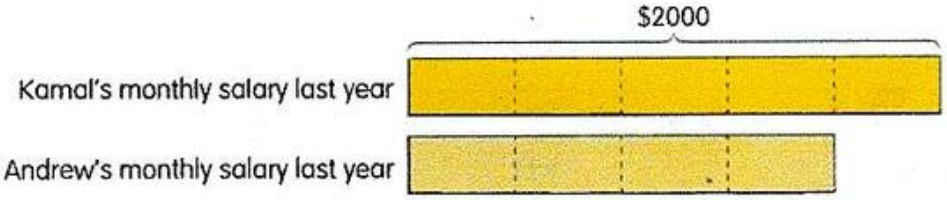
[ ]% of his savings = [ ] × [ ]

= [ ]

Joe's savings in the end was [ ].

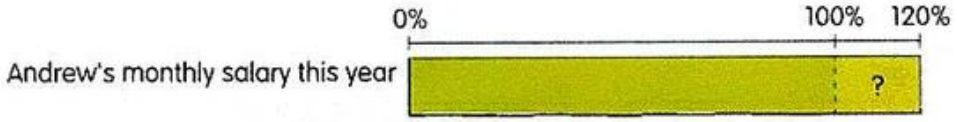
LEARN

Last year, Kamal's monthly salary was \$2000. Andrew's monthly salary was $\frac{4}{5}$ of Kamal's monthly salary. This year, Andrew's monthly salary increased by 20%. Find the increase in Andrew's monthly salary from last year to this year.



Andrew's monthly salary last year $= \frac{4}{5} \times \$2000$
$= \$1600$

We are comparing Andrew's monthly salary last year with his monthly salary this year. So, we take his monthly salary last year as the original quantity (100%).

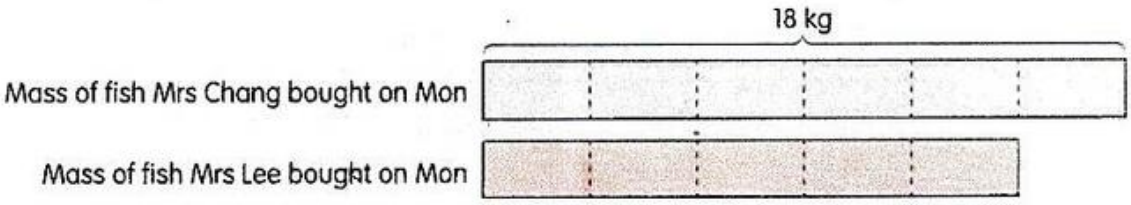


100% → \$1600
1% → \$1600 ÷ 100
= \$16
20% → \$16 × 20
= \$320

The increase in Andrew's monthly salary from last year to this year was \$320.

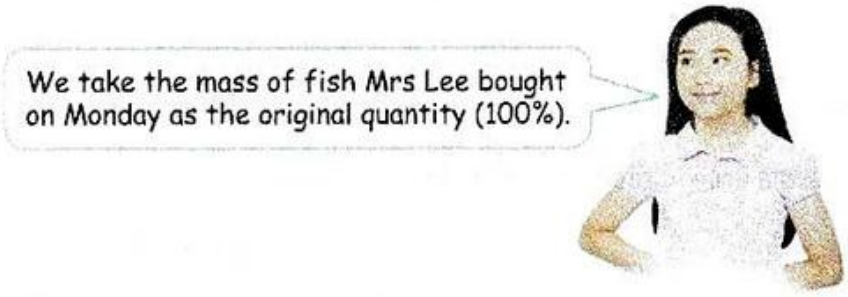
TRY 3

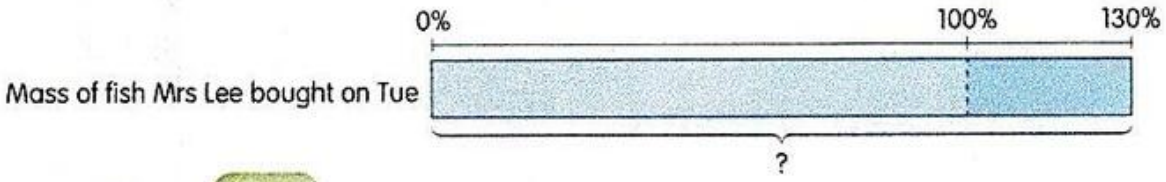
On Monday, Mrs Chang bought 18 kg of fish and Mrs Lee bought $\frac{5}{6}$ as much fish as Mrs Chang. On Tuesday, the mass of fish bought by Mrs Lee increased by 30%. Find the mass of fish Mrs Lee bought on Tuesday.



Mass of fish Mrs Lee bought on Monday = ☐ × 18

= ☐ kg





100% → ☐

1% → ☐ ÷ 100

= ☐

130% → ☐ × 130

= ☐

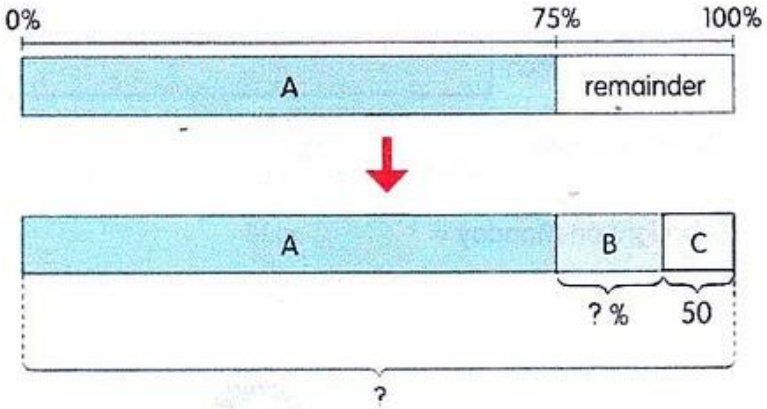
The mass of fish Mrs Lee bought on Tuesday was ☐ kg.

LEARN

The seats in a theatre are arranged in three categories, A, B and C. 75% of them are in Category A. 60% of the remaining seats are in Category B.

(a) What percentage of the seats in the theatre are Category B seats?

(b) There are 50 Category C seats. How many seats are there altogether in the theatre?



(a) $100\% - 75\% = 25\%$

25% of the seats are in Category B and Category C.

$\frac{60}{100} \times 25\% = 15\%$

15% of the seats in the theatre are Category B seats.

(b) $25\% - 15\% = 10\%$

10% of the seats are in Category C.

$10\% \rightarrow 50$
$1\% \rightarrow 50 \div 10$
$= 5$
$100\% \rightarrow 5 \times 100$
$= 500$

There are 500 seats altogether in the theatre.

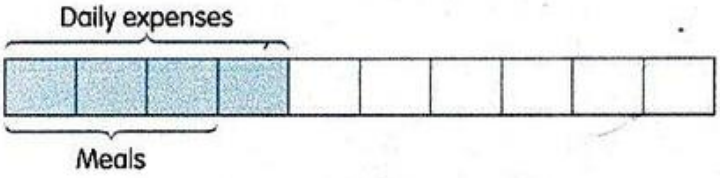
LEARN

Hands-On Activity Make connections between the concepts of 'percentage of percentage' and 'fraction of fraction'.

Work in pairs.

1. Read the word problem and draw a model to solve it.

   Kamil set aside 40% of his salary for his daily expenses. He spent 75% of it on meals. What percentage of his salary did he spend on meals?

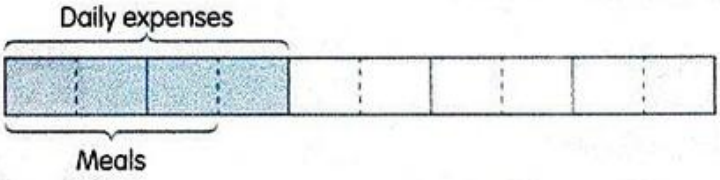


2. Your partner reads the word problem and draws a model to solve it.

   Kamil set aside $\frac{2}{5}$ of his salary for his daily expenses. He spent $\frac{3}{4}$ of it on meals.

   a. What fraction of his salary did he spend on meals?

   b. What percentage of his salary did he spend on meals?



3. Look at the models and the answers in 1 and 2. What do you notice?

4. Repeat 1 to 3 with the following word problems.

   a. i. Ada spent 50% of her savings on a dress and 75% of the remainder on a soft toy. What percentage of her savings did she spend on the soft toy?

   ii. Ada spent $\frac{1}{2}$ of her savings on a dress and $\frac{3}{4}$ of the remainder on a soft toy. What fraction of her savings did she spend on the soft toy?

   b. i. Ronan had some apples. He used 60% of them to make an apple strudel. He then gave 25% of the remainder to his neighbour. What percentage of the apples were given away?

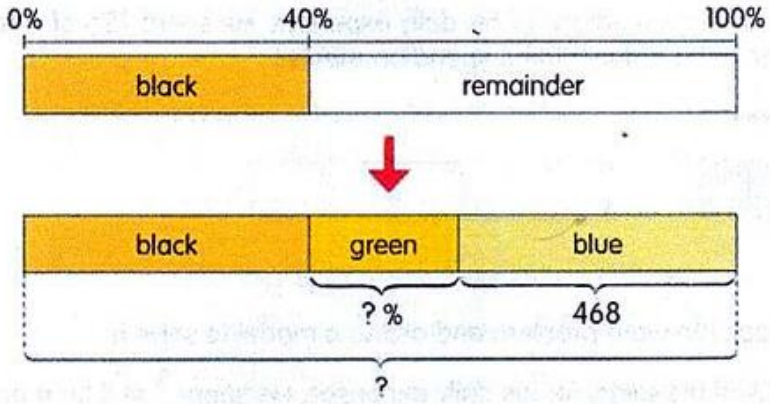
   ii. Ronan had some apples. He used $\frac{3}{5}$ of them to make an apple strudel. He then gave $\frac{1}{4}$ of the remainder to his neighbour. What fraction of the apples were given away?

TRY 4

The floor in a restaurant is tiled with identical black, blue and green tiles. 40% of the floor tiles are black. 35% of the remaining tiles are green and the rest of the 468 tiles are blue.

(a) What percentage of the tiles are green?

(b) How many tiles in total were used for tiling the restaurant floor?



(a) 100% − ▢ % = ▢ %

▢ % of the tiles are green and blue.

$\frac{\square}{100}$ × ▢ % = ▢ %

▢ % of the tiles are green.

35% = $\frac{\square}{100}$

(b) ▢ % − ▢ % = ▢ %

▢ % of the tiles are blue.

▢ % → 468

1% → 468 ÷ ▢

= ▢

100% → ▢ × 100

= ▢

▢ tiles in total were used for tiling the restaurant floor.

Workbook A: Practice 3, pages 101–108

Chapter 4 Review

1. In a class, 18 pupils wear glasses. This is 45% of the total number of pupils in the class. How many pupils are there in the class?

2. Mr Chen bought a desk for $1105. This was 85% of the usual price. How much was the usual price of the desk?

3. The number of members in a baking class decreased by 10% from July to August. There were 36 members in August. How many members were there in July?

4. The price of a packet of mushrooms sold at a supermarket in May was $3.20. In June, the same packet of mushrooms cost $2.99. Find the percentage decrease in its price from May to June. Give your answer correct to 1 decimal place.

5. Lisa's height was 146 cm in Primary 5. Her height in Primary 6 was 159 cm. Find the percentage increase in her height from Primary 5 to Primary 6. Give your answer correct to the nearest whole number.

6. Firdaus' monthly salary was $1850. He spent 25% of it on food and 10% of the remainder on utilities. How much did he spend on utilities?

7. During the Great Singapore Sale, a store gave a storewide discount of 20%. As a member of the store, Chelsea was entitled to an additional 10% discount on the discounted prices. What was the total percentage discount she enjoyed? Explain.

8 On a particular day, the temperature in the evening was 28°C. At midnight, it decreased to 21°C. At noon the next day, the temperature was 32°C.

(a) Find the percentage decrease in the temperature from evening to midnight.

(b) Find the percentage increase in the temperature from midnight to noon the next day. Give your answer correct to the nearest whole number.

9 Last year, the number of subscribers for a documentary channel was $\frac{3}{5}$ of the 8075 subscribers for the sports channel. This year, the number of subscribers for the documentary channel increased by 20%. Find the number of subscribers for the documentary channel this year.

10 40% of the pupils who took part in a holiday camp were from Primary 5. 55% of the remaining pupils were from Primary 6 and the rest of the 54 pupils were from Primary 4. How many pupils took part in the holiday camp?

LOOK BACK 11 P5 Rate

The table shows the charges at a car rental shop.

Time	Charge
Weekdays and weekends (24 h)	$78.50 per day
Every hour or part thereof	$7

Kassim rented a car from 07 00 on Monday to 16 35 on Wednesday. A 7% GST was charged to the total rental cost. How much did he pay altogether?

LOOK BACK 12 P5 Percentage

Sam bought a 2-ℓ carton of milk. He poured 30% of it into a jug, 20% of it into a bottle and 10% of it into a glass. How much milk was left in the carton? Give your answer in millilitres.

Workbook A:
Chapter 4 Review, pages 109–114
Maths Journal, pages 115–116

Chapter Wrap-Up

Percentage

Parts and Whole

- Find the whole given a part and the percentage.
- Find a percentage part of a whole.

Example
Regina bought 120 hotdogs. She gave away 35 hotdogs to her neighbours and used 20% of the remaining hotdogs in her cooking. How many hotdogs did she use in her cooking?

Number of hotdogs remaining
$= 120 - 35$
$= 85$

$100\% \rightarrow 85$
$1\% \rightarrow 85 \div 100$
$= 0.85$
$20\% \rightarrow 0.85 \times 20$
$= 17$

She used 17 hotdogs in her cooking.

Percentage Change

- Find the percentage change.

Example
The amount of rain last month was 160 mm. The amount of rain this month was 240 mm. What was the percentage increase in the amount of rain from last month to this month?

Increase in the amount of rain
$= 240 - 160$
$= 80$ mm

Percentage increase $= \frac{80}{160} \times 100\%$
$= 50\%$

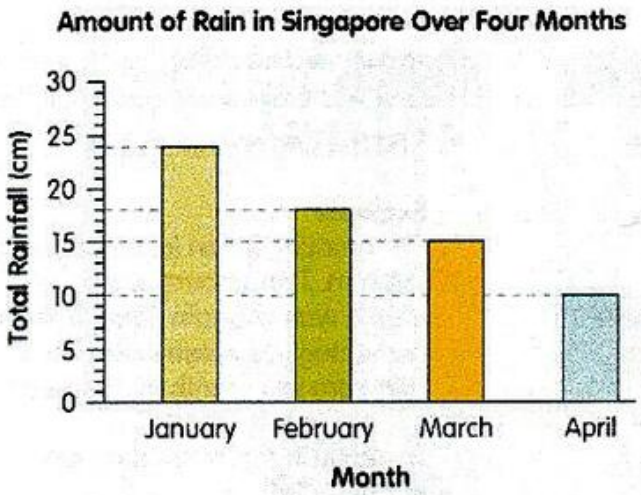
The percentage increase in the amount of rain from last month to this month was 50%.

Solving Word Problems

You may want to revisit the following topic:
- P5 Percentage

Put On Your Thinking Cap!

1. The bar graph shows the monthly amount of rain from January to April in Singapore in a particular year. Between which two months was there the greatest percentage decrease in the amount of rain?



2. Yati has a coin box containing some coins. 40% of the coins are 20-cent coins and the rest are 50-cent coins. What fraction of the 20-cent coins must Yati remove so that 20% of the coins left in the box are 20-cent coins?

3. If Rajesh buys a vacuum cleaner at a discount of 10% of the selling price, he needs $9.50 more. If he buys it at a discount of 15%, he will have $13.25 left. How much money does he have?

Workbook A:
Put On Your Thinking Cap! pages 117–118
Review 2, pages 119–128

CHAPTER 5

Circles

Lessons

1. Radius, Diameter and Circumference
2. Area of a Circle
3. Composite Figures

Big Idea

π is the ratio of the circumference of a circle to its diameter.

Lesson 1 Radius, Diameter and Circumference

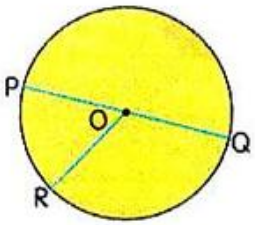
Radius and Diameter

Before you learn ...

Fold a circle into four equal parts. Unfold the circle and label its centre as O.
Divide the circle into four equal parts using a different pair of fold lines.
What do you notice about the fold lines and the centre of the circle?

LEARN

A circle can be drawn with a pair of compasses.

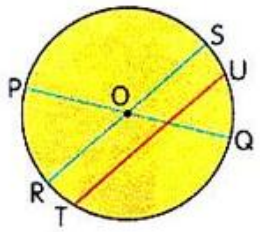


O is the **centre** of the circle.
OP is a **radius** of the circle.
OQ and OR are **radii** of the circle.

The plural of radius is radii.

LEARN

In the circle, O is the centre of the circle. The lines POQ and ROS pass through the centre O.



POQ is a **diameter** of the circle.
ROS is another diameter of the circle.
TU is not a diameter of the circle as it **does not** pass through the centre of the circle.

Diameters of a circle pass through its centre.

Diameter = 2 × Radius

Bernard is standing at point O on the ground. He walks 1 m from that point in a straight line. His friends do the same, but in different directions. Together, they form a circle.

(a) What does the distance of 1 m represent?

(b) If two children directly opposite each other hold a string that passes through the start point, what does the string represent?

LEARN

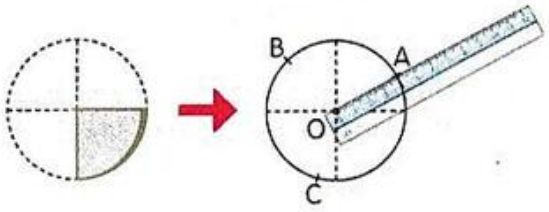
Hands-On Activity

Describe circles, explore the relationships between different lengths in a circle and relate the sizes of circles to their diameters.

Work in groups.

1. Use the circle cut-outs provided by your teacher. Fold a circle into quarters. Mark the centre of the circle as O.

2. Mark three points, A, B and C on the circle. Measure the length between each of these three points and the centre O. What do you notice?



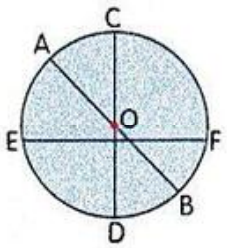
3. Measure the diameter of the circle. Compare it with the lengths in 2.
What do you notice about the diameter of the circle and its radius?

4. Switch roles. Repeat 1 to 3 with other circle cut-outs.

5. What do you notice about the diameter of the circle as the size of the circle increases?

TRY

1 (a) (i) In the figure, O is the centre of the circle. Name the diameters. _____ , _____



(ii) Which line is not a diameter? Explain. _____

(b) The radius of a circle is 6 cm. What is the length of its diameter? _____

(c) The diameter of a circle is 15 cm. What is the length of its radius? _____

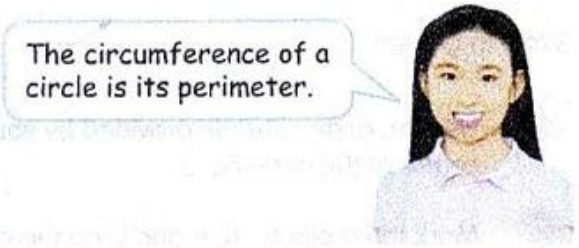
Circumference

Before you learn ...

Ben says the ratio of the perimeter of a circle to its diameter is the same for all circles.
Do you agree? Explain.

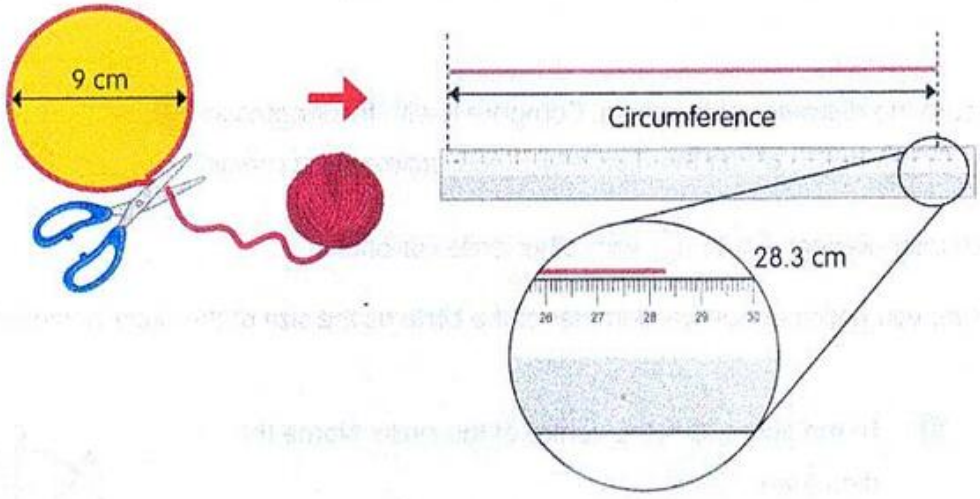
LEARN

A hula hoop has the shape of a circle.
The length around the hoop is called its circumference.

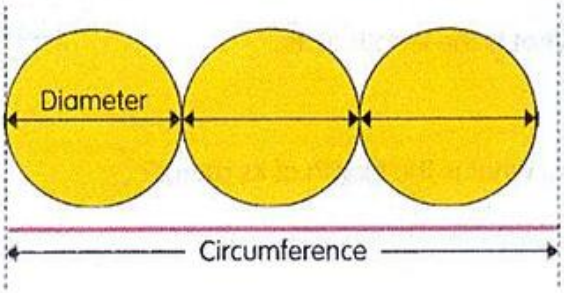


LEARN

Adeline used a string to go round a circle of diameter 9 cm. Then, she measured the length of the piece of string to find the circumference of the circle.



She found that the circumference of the circle is slightly more than three times its diameter.



LEARN

Hands-On Activity

Explore how the circumferences and diameters of circles are related.

Work in pairs.

1. Use the circle cut-outs provided by your teacher.

2. Use a string to go round each circle. Then, measure the length of the string correct to 1 decimal place. Record each circumference in the following table.

Circle	Diameter (cm)	Circumference (cm)	Circumference ÷ Diameter (correct to 1 decimal place)
A	5		
B	7		
C	8		

3. What do you notice about the answers for $\frac{\text{Circumference}}{\text{Diameter}}$ you obtained in 2?

4. Use your calculator to display the value of π. Give the value of π correct to the following number of decimal places.

   a. 1 decimal place

   b. 2 decimal places

5. What do you notice about the value for $\frac{\text{Circumference}}{\text{Diameter}}$ in 2 and the value of π in 4?

The circumference of any circle divided by its diameter always has the same value. This constant value is denoted by the Greek letter π, which is read as 'pie'.
3.14 and $\frac{22}{7}$ are approximations for the value of π.

LEARN

The diameter of a circular plate is 28 cm. Find its circumference.

(Take $\pi = \frac{22}{7}$.)

Circumference of plate $= \pi d$

$= \frac{22}{7} \times 28^{4}$

$= 22 \times 4$

$= 88$ cm

The circumference of the circular plate is 88 cm.

Circumference $= \pi \times$ Diameter
$= \pi d$

LEARN

The radius of a bicycle wheel is 27.5 cm. Find its circumference. (Take $\pi = 3.14$.)

Circumference of bicycle wheel $= 2\pi r$

$= 2 \times 3.14 \times 27.5$

$= 172.7$ cm

The circumference of the bicyce wheel is 172.7 cm.

Circumference $= 2 \times \pi \times$ Radius
$= 2\pi r$

TRY 2A

Find the circumference of a circle with the given diameter. Give your answers correct to 1 decimal place. (Take $\pi = 3.14$.)

(a) 12.5 cm (b) 16 cm (c) 8.25 cm

TRY 2B

Find the circumference of a circle with the given radius. (Take $\pi = \frac{22}{7}$.)

(a) 14 cm (b) 42 cm (c) 21 cm

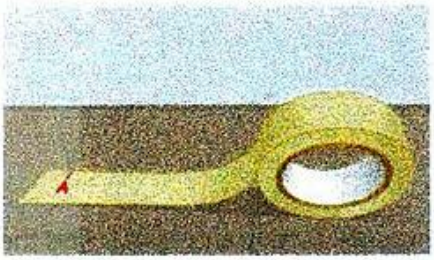
LEARN

Hands-On Activity

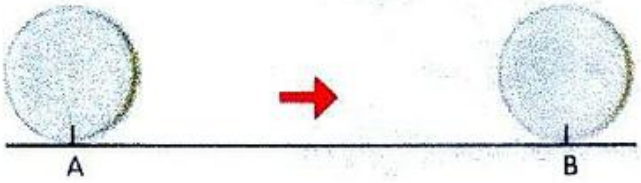
Relate the distance travelled by a circle when it makes one complete turn and its circumference.

Work in pairs.

1. Use a string to measure the circumference of a circular disc, for example, the lid of a cup.
2. Mark a point on the disc with a marker as shown.
3. Put some tape on the floor to form a straight line that is about 40 cm long. Mark a point A on the tape.



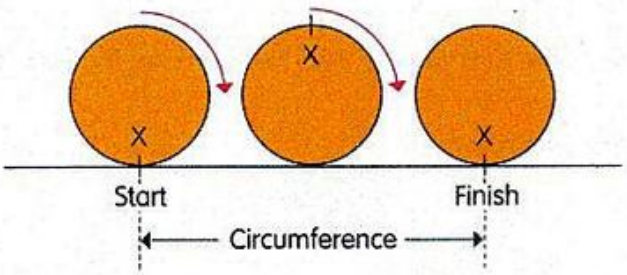
4. Place the marked point on the disc against point A and roll the disc along the length of the tape until the point on the disc meets the tape again. Mark its position as B on the tape.



5. Measure the distance AB.
6. How many complete turns does the disc make to move through the distance AB?
7. Compare the distance AB with circumference of the circle. What do you notice?

LEARN

Tom found that the distance a disc travelled after making a complete turn was equal to its circumference. The diameter of the disc was 0.71 m. Find the distance travelled by the disc correct to 1 decimal place. (Take $\pi = 3.14$.)



Distance travelled by disc = Circumference of disc
$= \pi d$
$= 3.14 \times 0.71$
≈ 2.2 m

The distance travelled by the disc was 2.2 m.

TRY 3A

Mr Tan rolled a bicycle wheel of diameter 56 cm through 10 complete turns. Find the distance travelled by the bicycle wheel. $\left(\text{Take } \pi = \frac{22}{7}.\right)$

Distance travelled by bicycle wheel = [ ] [ ] Circumference of bicycle wheel
= [ ] [ ] πd
= [ ] cm

The distance travelled by the bicycle wheel was [ ] cm.

TRY 3B

A circular lid has a diameter of 7 cm. How many complete turns must it make to cover a distance of 110 cm? $\left(\text{Take } \pi = \frac{22}{7}.\right)$

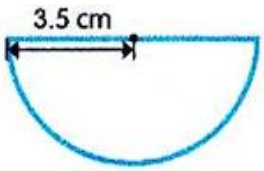
Circumference of lid = πd
= [ ] cm

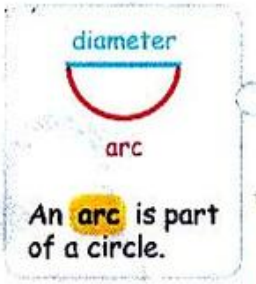
Number of complete turns = [ ] ÷ [ ]
= [ ]

The lid must make [ ] complete turns to cover 110 cm.

LEARN

Munah drew a semicircle of radius 3.5 cm.
Find the perimeter of the semicircle. $\left(\text{Take } \pi = \frac{22}{7}.\right)$





An **arc** is part of a circle.

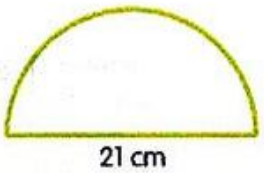
Perimeter of semicircle = Length of arc + Diameter

$$= \left(\frac{1}{2} \times 2\pi r\right) + 7$$
$$= \left(\frac{1}{2} \times 2 \times \frac{22}{7} \times 3.5\right) + 7$$
$$= 18 \text{ cm}$$

The perimeter of the semicircle is 18 cm.

TRY 4

A length of wire is bent into a semicircle of diameter 21 cm. Find its perimeter.
$\left(\text{Take } \pi = \frac{22}{7}.\right)$



Perimeter of wire = Length of arc + Diameter

$= \left(\frac{1}{2}$ ▭ $\pi d\right) +$ ▭

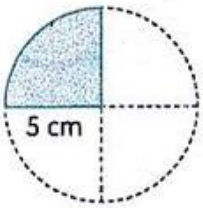
$= \left($ ▭ ▭ ▭ ▭ ▭ $\right) +$ ▭

$=$ ▭ cm

The perimeter of the wire is ▭ cm.

LEARN 4

Jamie folded a circle of radius 5 cm into four equal parts and cut out 1 part. Find the perimeter of the cut-out part. (Take $\pi = 3.14$.)



Perimeter of cut-out part = Length of arc + 2 Radii

$$= \left(\frac{1}{4} \times 2\pi r\right) + (2 \times 5)$$

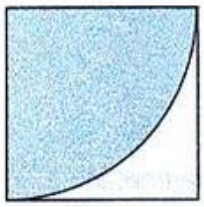
$$= \left(\frac{1}{4} \times 2 \times 3.14 \times 5\right) + 10$$

$$= 17.85 \text{ cm}$$

The perimeter of the cut-out part is 17.85 cm.

TRY 5

A quarter circle is cut out from a square of side 10 cm.
Find the perimeter of the quarter circle. (Take $\pi = 3.14$.)



Perimeter of quarter circle
= Length of arc + 2 Radii

= (×) + (2 ×)

= cm

The perimeter of the quarter circle is cm.

Workbook A:
Practices 1A and 1B
pages 129–138

Lesson 2 Area of a Circle

Before you learn ...

Chloe says that the area of a circle of radius 4 cm is about the same as the area of a rectangle that measures 12 cm by 4 cm. Is she correct? Explain using a piece of 1-cm square grid paper.

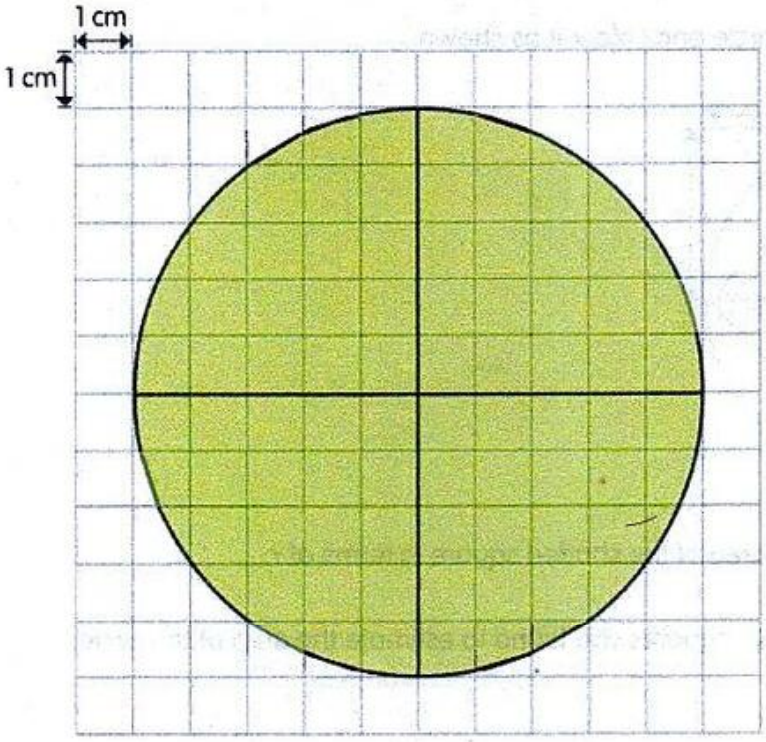
LEARN

Hands-On Activity

Station 1 Estimate the area of a circle using a square grid.

Work in pairs.

1. Look at the circle on the square grid.



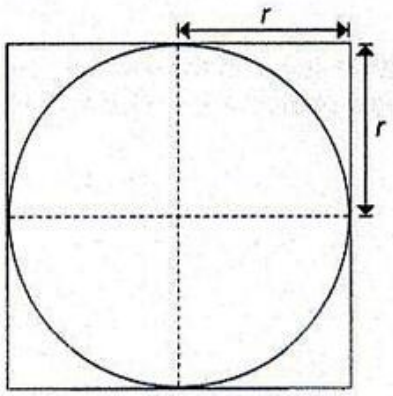
2. Your partner finds the area of a quarter circle by counting the number of squares.

3. Use the answer in 2 to estimate the area of the circle. Explain.

Station 2 Estimate the area of a circle using squares.

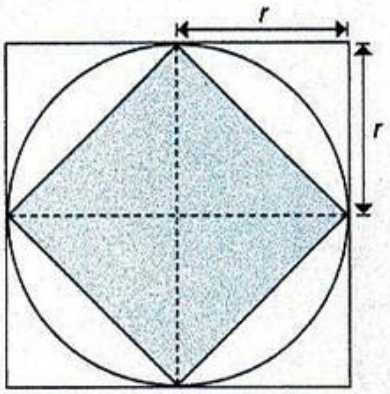
Work in pairs.

1. Use the cut-out provided by your teacher. It shows a circle of radius r in a square.



2. Your partner finds the area of the square in terms of r.

3. Draw a square in the circle and colour it as shown.



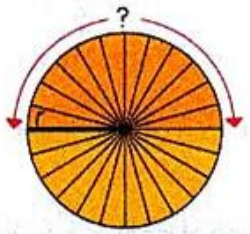
4. Your partner finds the area of the shaded square in terms of r.

5. Use the areas of the two squares you found to estimate the area of the circle.

Activity 3 Find the area of a circle.

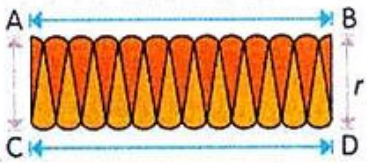
Work in groups.

1. Use the circle cut-out provided by your teacher.
Find half its circumference in terms of π and r.



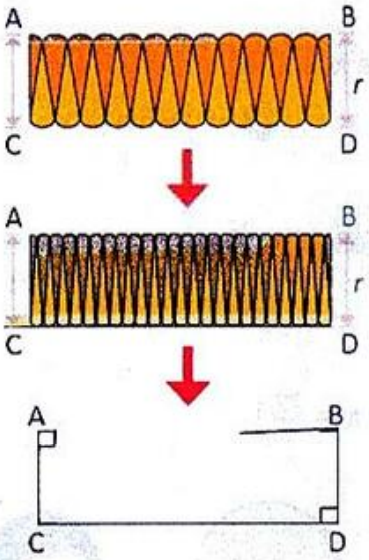
2. Cut the circle into 24 equal pieces. Cut one piece into two halves as shown.

3. Arrange all the pieces to form the figure as shown.



Area of circle = Area of figure
Compare the lengths of AB and CD with the circumference of the circle in 1.
What do you notice?

4. When the circle is cut into many more equal pieces and arranged as shown in 3, the following is obtained.



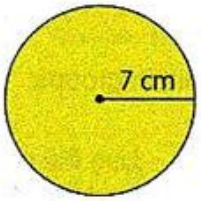
What are the length and the breadth of the rectangle in terms of π and r?

5. a. What is the area of the rectangle in 4?

b. What can you conclude about the area of the circle?

LEARN 1

The radius of a circular disc is 7 cm. Find its area. $\left(\text{Take } \pi = \frac{22}{7}.\right)$



Area of disc $= \pi \times r \times r$

$= \frac{22}{7} \times 7 \times 7$

$= 154 \text{ cm}^2$

The area of the disc is 154 cm².

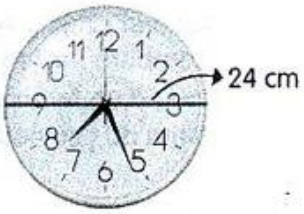
Area of circle = π × Radius × Radius
= π × r × r

LEARN 2

The diameter of a circular clock is 24 cm. Find its area. (Take $\pi = 3.14$.)

Radius $= 24 \div 2$

$= 12 \text{ cm}$



Area of clock $= \pi \times r \times r$

$= 3.14 \times 12 \times 12$

$= 452.16 \text{ cm}^2$

The area of the clock is 452.16 cm².

TRY 1A

Find the area of each circle with the given radius. (Take $\pi = 3.14$.)

(a) 11 cm (b) 15 cm (c) 26 cm

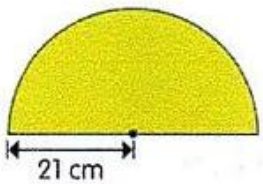
TRY 1B

Find the area of each circle with the given diameter. $\left(\text{Take } \pi = \frac{22}{7}.\right)$

(a) 14 cm (b) 21 cm (c) 35 cm

LEARN 3

A semicircle has a radius of 21 cm. Find its area. $\left(\text{Take } \pi = \frac{22}{7}.\right)$



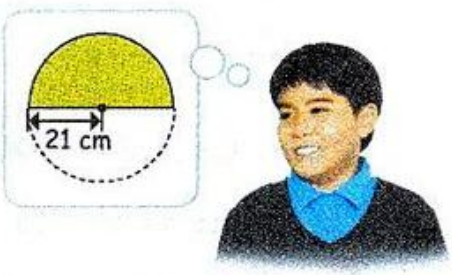
Area of semicircle

$= \frac{1}{2} \times$ Area of circle

$= \frac{1}{2} \times \pi \times r \times r$

$= \frac{1}{2} \times \frac{22}{7} \times 21 \times 21$

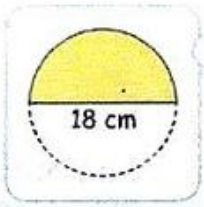
$= 693 \text{ cm}^2$



The area of the semicircle is 693 cm².

TRY 2

A round paper plate of diameter 18 cm is cut into two halves. Find the area of each half. (Take $\pi = 3.14$.)



Radius of round paper plate = [ ] [ ] 2

= [ ] cm

Area of each half = [ ] [ ] Area of circle

= [ ] [ ] $\pi \times r \times r$

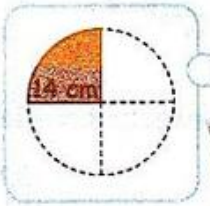
= [ ] [ ] [ ] [ ] [ ] [ ] [ ]

= [ ] cm^2

The area of each half of the paper plate is [ ] cm^2.

LEARN 3

Jessie cut a circular cardboard of radius 14 cm into four equal parts. Find the area of each part. Leave your answer in terms of π.



Area of each part = $\frac{1}{4}$ × Area of circle

= $\frac{1}{4} \times \pi \times r \times r$

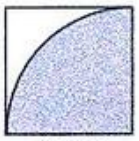
= $\frac{1}{4} \times \pi \times 14^{7} \times 14^{7}$

= 49π cm^2

The area of each part is 49π cm^2.

TRY 3

A quarter circle is cut out from a square of side 6 cm. Find its area in terms of π.



Area of quarter circle = [ ] [ ] $\pi \times r \times r$

= [ ] [ ] [ ] [ ] [ ] [ ] [ ]

= [ ] cm^2

The area of the quarter circle is [ ] cm^2.

Workbook A: Practice 2 pages 139–142

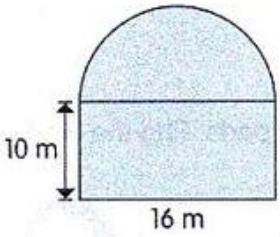
Lesson 3 Composite Figures

Before you learn ...

Fold a piece of circular paper into quarters. Then, cut out a quarter. How would you find the perimeter and area of the remaining figure? Explain.

LEARN

The figure shows a flower bed that is made up of a semicircle and a rectangle of length 16 m and breadth 10 m. Find its perimeter and area. (Take $\pi = 3.14$.)



Perimeter of flower bed $= \left(\frac{1}{2} \times 3.14 \times 16\right) + (2 \times 10) + 16$
$= 25.12 + 20 + 16$
$= 61.12$ m

Use estimation to check if your answer is reasonable.

The perimeter of the flower bed is 61.12 m.

Area of flower bed = Area of semicircle + Area of rectangle

Radius of semicircle $= \frac{1}{2} \times 16$
$= 8$ m

Area of semicircle $= \frac{1}{2} \times 3.14 \times 8 \times 8$
$= 100.48$ m^2

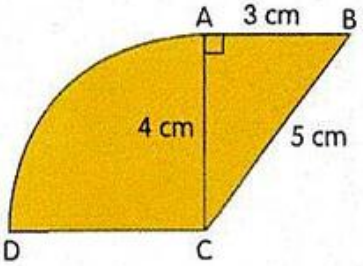
Area of rectangle $= 16 \times 10$
$= 160$ m^2

Area of flower bed $= 100.48 + 160$
$= 260.48$ m^2

The area of the flower bed is 260.48 m^2.

LEARN

The figure shows a company logo that is made up of a triangle and a quarter circle. AB = 3 cm, AC = 4 cm and BC = 5 cm. Find its perimeter and area. Give your answers correct to 1 decimal place.



Perimeter of logo $= \left(\frac{1}{4} \times 2 \times \pi \times 4 \right) + (4 + 5 + 3)$

$= 18.3$ cm (correct to 1 decimal place)

The perimeter of the logo is 18.3 cm.

Area of logo = Area of quarter circle + Area of triangle

Area of quarter circle $= \frac{1}{4} \times \pi \times 4 \times 4$

$= 4\pi$ cm^2

Area of triangle $= \frac{1}{2} \times 3 \times 4$

$= 6$ cm^2

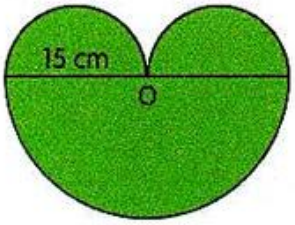
Area of logo $= 4\pi + 6$

$= 18.6$ cm^2 (correct to 1 decimal place)

The area of the logo is 18.6 cm^2.

TRY 1A

The figure is made up of three semicircles. O is the centre of the large semicircle and its radius is 15 cm. Find the perimeter and area of the figure. Give your answer correct to 1 decimal place. (Take $\pi = 3.14$.)



Diameter of large semicircle =

= cm

Radius of each small semicircle =

= cm

Perimeter of figure = ( ) + (3.14)

=

=

The perimeter of the figure is cm.

Area of large semicircle = $\frac{1}{2}$ 3.14

= cm^2

Area of two small semicircles = Area of 1 small circle

= 3.14

= cm^2

Area of figure =

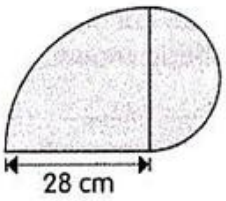
=

= cm^2 (correct to 1 decimal place)

The area of the figure is cm^2.

TRY 1B

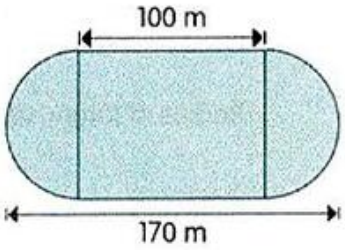
A floor mat is made up of a semicircle and a quarter circle. The radius of the quarter circle is 28 cm. Find the perimeter and area of the mat. $\left(\text{Take } \pi = \frac{22}{7}.\right)$



Perimeter = _____, Area = _____

TRY 1C

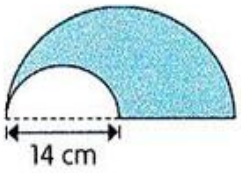
A field is made up of a rectangle and two identical semicircles. The length of the field is 170 m. The length of the rectangle is 100 m. Find the perimeter and area of the field. Give your answers correct to 2 decimal places.

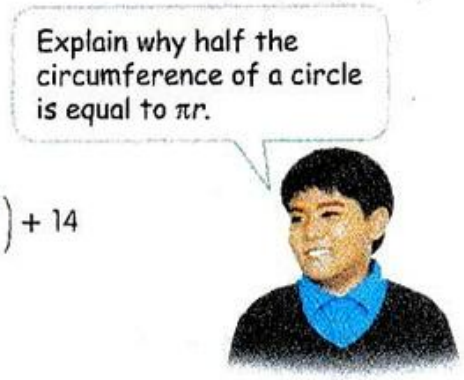


Perimeter = _____, Area = _____

LEARN

The figure is made up of two semicircles. Find the perimeter and area of the shaded part. $\left(\text{Take } \pi = \frac{22}{7}.\right)$





Radius of small semicircle = $14 \div 2 = 7$ cm

Perimeter of shaded part $= \left(\frac{22}{7} \times 14^{2}\right) + \left(\frac{22}{7} \times 7^{1}\right) + 14$

$= 44 + 22 + 14$

$= 80$ cm

The perimeter of the shaded part is 80 cm.

Area of shaded part = Area of large semicircle − Area of small semicircle

Area of large semicircle $= \frac{1}{2} \times \frac{22^{11}}{7} \times 14^{2} \times 14$

$= 308$ cm^2

Area of small semicircle $= \frac{1}{2} \times \frac{22^{11}}{7} \times 7^{1} \times 7$

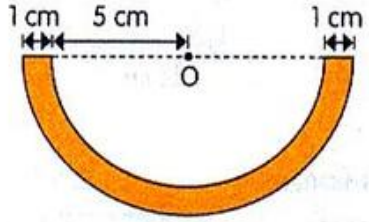
$= 77$ cm^2

Area of shaded part $= 308 - 77 = 231$ cm^2

The area of the shaded part is 231 cm^2.

TRY 2

Ruby cut out a smaller semicircle of radius 5 cm from a larger semicircle and obtained the shape shown. Find the perimeter and area of the shape. (Take $\pi = 3.14$.)



Radius of larger semicircle = [ ] + [ ]

= [ ] cm

Perimeter of shape

= ([ ] × [ ] × [ ]) + ([ ] × [ ] × [ ]) + 2

= [ ] + [ ] + 2

= [ ] cm

The perimeter of the shape is [ ] cm.

Area of shape

= Area of larger semicircle − Area of smaller semicircle

Area of larger semicircle = [ ] [ ] [ ] [ ] [ ] [ ] [ ]

= [ ] cm^2

Area of smaller semicircle = [ ] [ ] [ ] [ ] [ ] [ ] [ ]

= [ ] cm^2

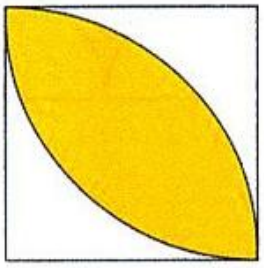
Area of shape = [ ] − [ ]

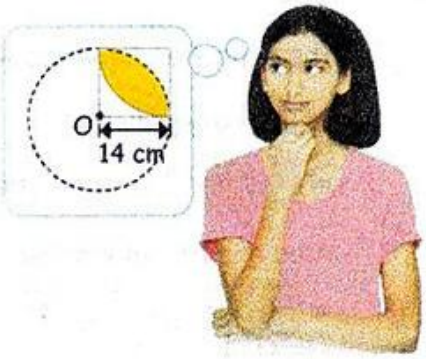
= [ ] cm^2

The area of the shape is [ ] cm^2.

LEARN

The shaded part in the figure is enclosed by two identical quarter circles within a square of side 14 cm. Find the perimeter and area of the shaded part. $\left(\text{Take } \pi = \frac{22}{7}.\right)$

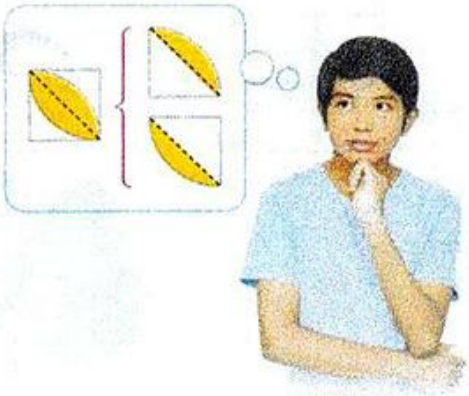




Perimeter of shaded part $= \cancel{2}^{1} \times \frac{1}{\cancel{4}_{2}} \times \cancel{2}^{1} \times \frac{22}{\cancel{7}_{1}} \times \cancel{14}^{2}$

$= 44$ cm

The perimeter of the shaded part is 44 cm.



Area of shaded part
= 2 × (Area of each quarter circle − Area of triangle)

Area of each quarter circle $= \frac{1}{\cancel{4}_{2}} \times \frac{\cancel{22}^{11}}{\cancel{7}_{1}} \times \cancel{14}^{2} \times 14$

$= 154$ cm^2

Area of triangle $= \frac{1}{\cancel{2}_{1}} \times \cancel{14}^{7} \times 14$

$= 98$ cm^2

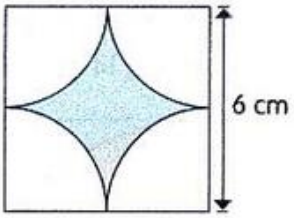
Area of shaded part $= 2 \times (154 - 98)$

$= 112$ cm^2

The area of the shaded part is 112 cm^2.

TRY 3A

The figure is formed by four identical quarter circles that lie inside a square of side 6 cm. Find the perimeter and area of the shaded part. (Take $\pi = 3.14$.)



Perimeter of shaded part

= 4 ( )

= ( )

= ( ) cm

The perimeter of the shaded part is ( ) cm.

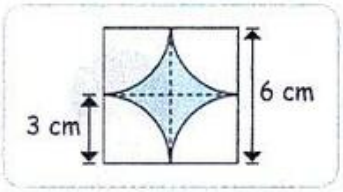
Area of shaded part

= ( ) (Area of each small square − Area of each quarter circle)

Area of each small square

= ( )

= ( ) cm^2



Area of each quarter circle

= ( )

= ( ) cm^2

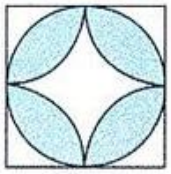
Area of shaded part = ( ) ( )

= ( ) cm^2

The area of the shaded part is ( ) cm^2.

TRY 3B

The figure shows a circle and four quarter circles inside a square of side 14 cm. Find the total area of the shaded parts. (Take $\pi = \frac{22}{7}$.) ( )



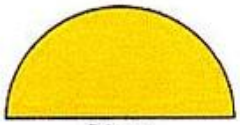
Workbook A:
Practice 3
pages 143–152

Chapter 5 Review

1. Find the area and perimeter of the semicircle. $\left(\text{Take } \pi = \frac{22}{7}.\right)$

Area =

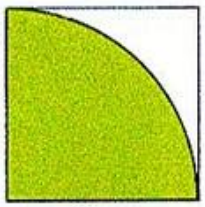
Perimeter =



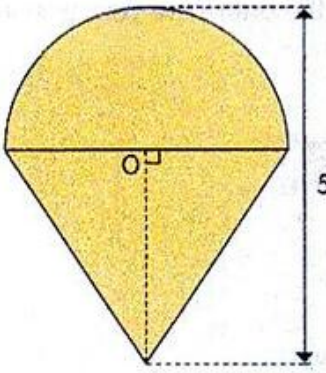
2. Find the area and perimeter of the shaded part of the figure. (Take $\pi = 3.14$.)

Area =

Perimeter =

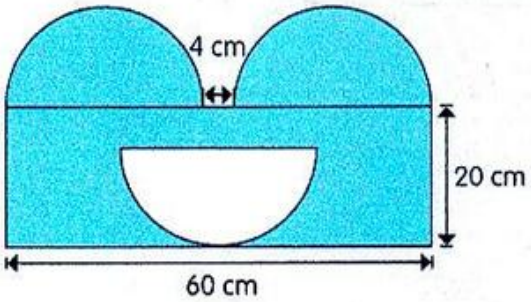


3. The figure is made up of a semicircle and a triangle. The ratio of the height of the triangle to the radius of the circle is 3 : 2. Find the area of the figure. (Take $\pi = 3.14$.)

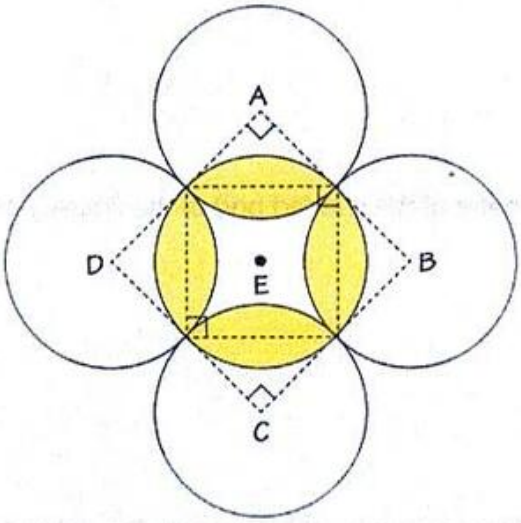


4. The figure is made up of a rectangle and three identical semicircles.

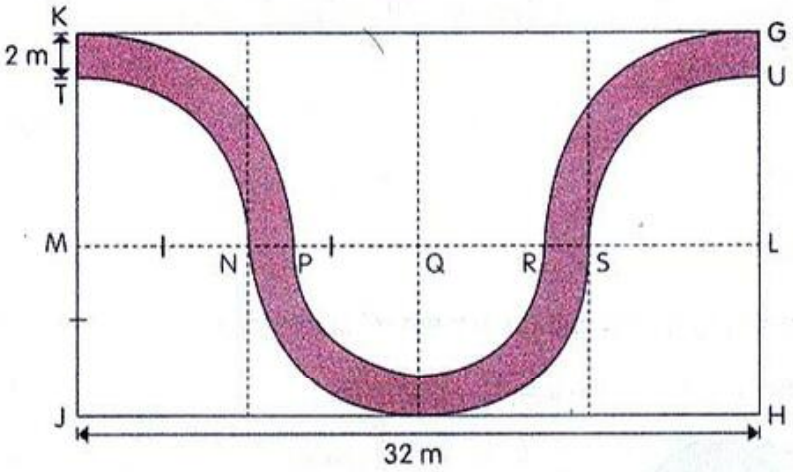
Find the area of the shaded part. $\left(\text{Take } \pi = \frac{22}{7}.\right)$



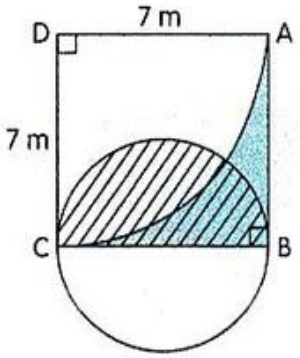
5 The figure shows five identical circles with Centres A, B, C, D and E. The shaded parts are identical. Each circle has a diameter of 42 cm. Find the area of the shaded part. Give your answer correct to 1 decimal place.



6 The figure shows a path of width 2 m in a rectangular park of length 32 m. The outline of the path is made up of quarter circles with Centres M and L and semicircles with Centre Q. MN = MJ = NQ and KM = MP. Find the area of the path. Give your answer correct to 1 decimal place.

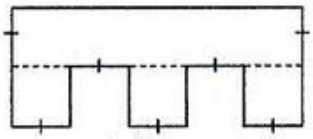


7 The figure shows a square, a quarter circle and a circle What is the difference in area between the shaded semicircle and the shaded region ABC? Give your answer as a mixed number in its simplest form. $\left(\text{Take } \pi = \frac{22}{7}.\right)$



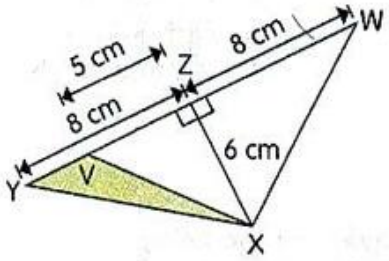
LOOK BACK 8 P4 Area and perimeter

The figure is made up of three squares and a rectangle.
The side of each square is 9 cm.
Find its perimeter and area.



LOOK BACK 9 P5 Area of a Triangle

In the figure, YZ = ZW = 8 cm, VZ = 5 cm and ∠WZX = 90°. What fraction of the area of Triangle WYX is the area of the shaded part?



LOOK BACK 10 P5 Area of a Triangle

Figure B is made up of four identical right-angled triangles as shown in Figure A.
Four times the perimeter of Figure A is 96 cm. The perimeter of Figure B is 48 cm.
What is the length of XY?

Figure A

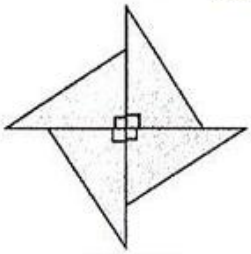


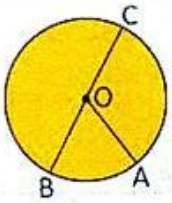
Figure B

Workbook A:
Chapter 5 Review, pages 153–157
Maths Journal, page 158

Chapter Wrap-Up

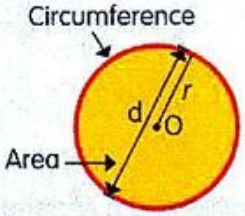
Circles

Parts of a Circle



- O is the centre of the circle.
  OA is a radius.
  BC is a diameter.
  BC = 2 × OA

Circumference and Area

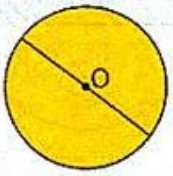


- Circumference
  $= \pi \times$ diameter
  $= \pi d$

  or

  Circumference
  $= 2 \times \pi \times$ radius
  $= 2\pi r$
- Area
  $= \pi \times$ radius $\times$ radius
  $= \pi \times r \times r$

Semicircle and Quarter Circle



- A diameter divides a circle into two semicircles.

- Two perpendicular diameters divide a circle into four quarter circles.

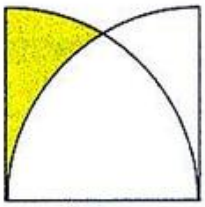
Finding perimeters and areas of composite figures

You may want to revisit the following topics:

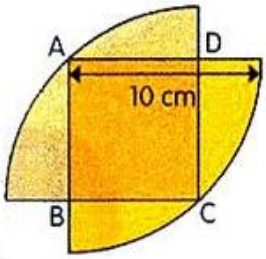
- P4 Area and Perimeter
- P5 Area of a Triangle

Put On Your Thinking Cap!

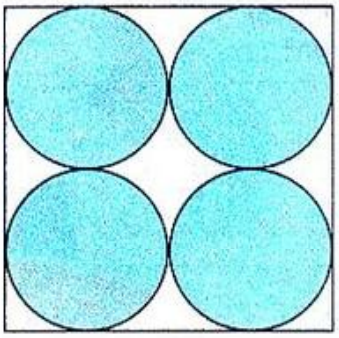
1. The figure shows two identical quarter circles each of radius 15 cm. Find the perimeter of the shaded part. Give your answer as a mixed number in its simplest form. (Take $\pi = \frac{22}{7}$.)



2. The figure is made up of two quarter circles each of radius 10 cm. ABCD is a rectangle of length 8 cm and breadth 6 cm. Find the area and perimeter of the figure. (Take $\pi = 3.14$.)



3. Four identical circles that touch one another lie inside a square as shown. What fraction of the square is not covered by the circles? (Take $\pi = \frac{22}{7}$.)



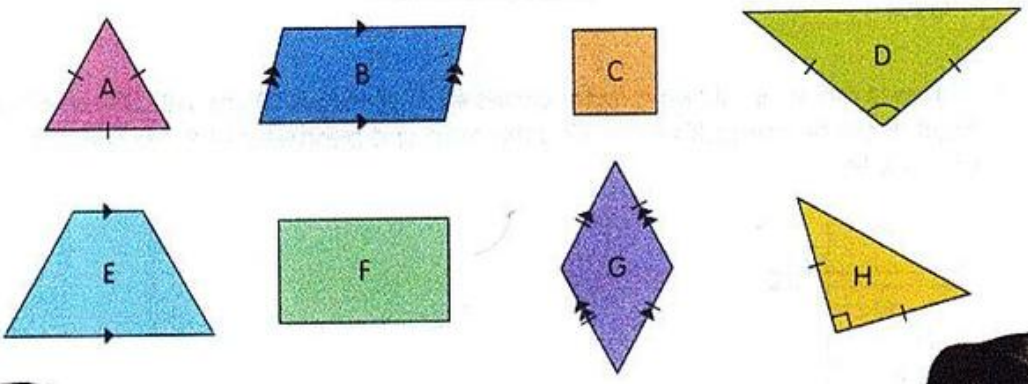
Workbook A:
Put On Your Thinking Cap!
pages 159–160

CHAPTER 6

Angles in Geometric Figures

Maths Quiz of the Week

Name the shapes.



I recognise some of these shapes. A is an equilateral triangle, D is an isosceles triangle and H is a right-angled triangle.

Is B a trapezium or a parallelogram?

Big Idea

The properties of a geometric figure are the relationships between its sides and angles.

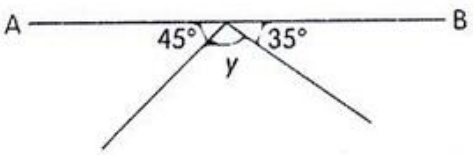
Lesson

1 Finding Unknown Angles in Geometric Figures

Lesson 1 Finding Unknown Angles in Geometric Figures

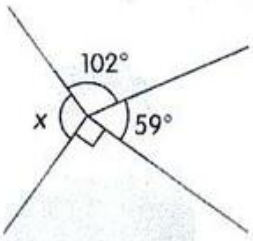
Recall

1 AB is a straight line. Find $\angle y$.



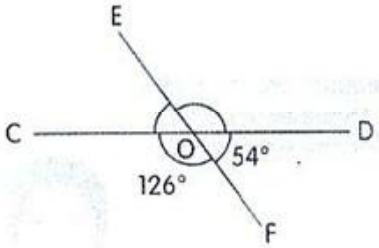
$\angle y = 180° - 45° - 35°$
$= 100°$

2 In the diagram, all the lines meet at a point. Find $\angle x$.



$\angle x = 360° - 102° - 59° - 90°$
$= 109°$

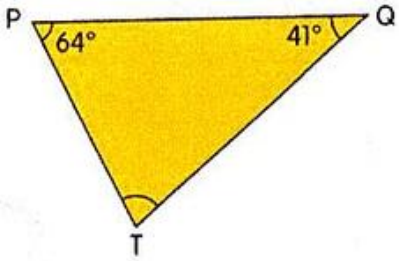
3 CD and EF are straight lines. Find $\angle COE$ and $\angle EOD$.



$\angle COE = \angle DOF$
$= 54°$

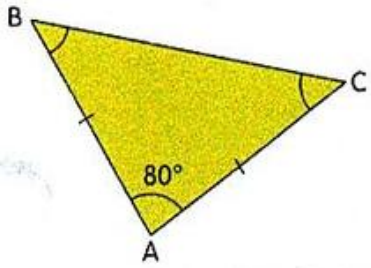
$\angle EOD = \angle COF$
$= 126°$

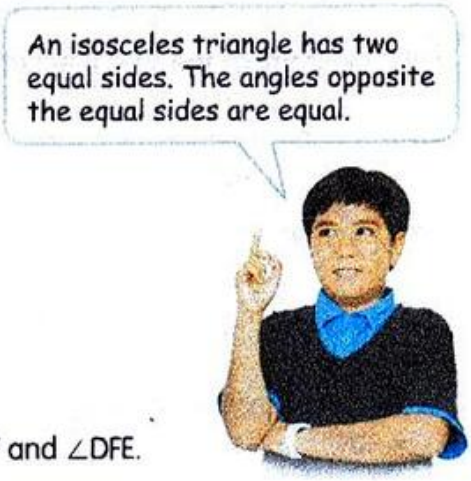
4 In triangle PQT, $\angle TPQ = 64°$ and $\angle PQT = 41°$. Find $\angle PTQ$.



$\angle PTQ = 180° - 64° - 41°$
$= 75°$

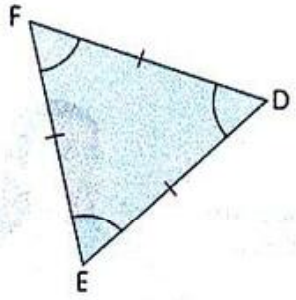
5 ABC is an isosceles triangle. AB = AC. Find $\angle ACB$ and $\angle ABC$.

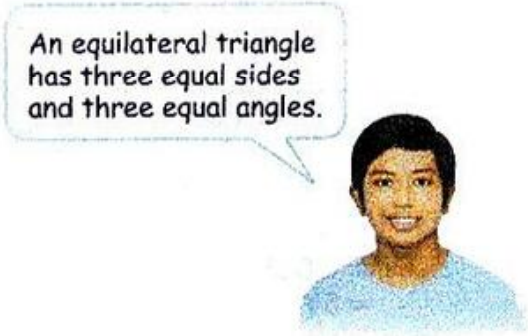




$\angle ACB = \angle ABC$
$= (180° - 80°) \div 2$
$= 50°$

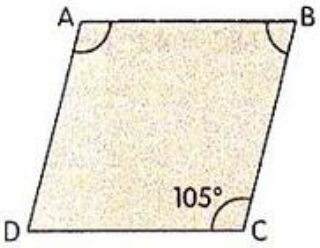
6 DEF is an equilateral triangle. Find $\angle FDE$, $\angle DEF$ and $\angle DFE$.

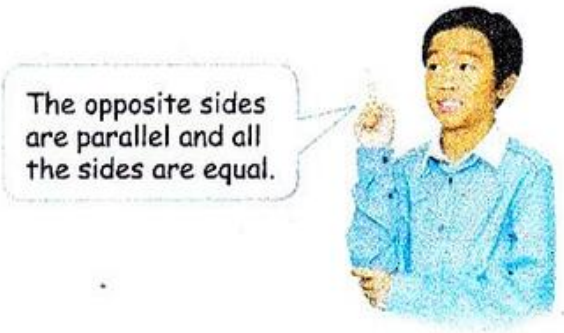




$\angle FDE = \angle DEF$
$= \angle DFE$
$= 180° \div 3$
$= 60°$

7 ABCD is a rhombus. Find $\angle DAB$ and $\angle ABC$.

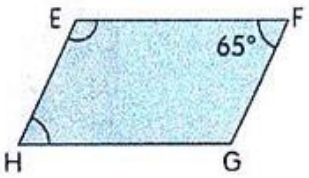




$\angle DAB = \angle BCD$
$= 105°$

$\angle ABC = 180° - 105°$
$= 75°$

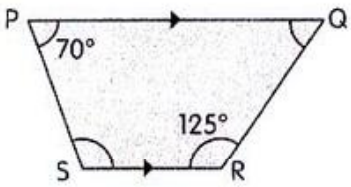
8 EFGH is a parallelogram. Find $\angle EHG$ and $\angle HEF$.



$\angle EHG = \angle EFG$
$= 65°$

$\angle HEF = 180° - 65°$
$= 115°$

9 PQRS is a trapezium. Find $\angle PSR$ and $\angle PQR$.



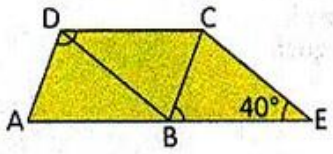
$\angle PSR = 180° - 70°$
$= 110°$

$\angle PQR = 180° - 125°$
$= 55°$

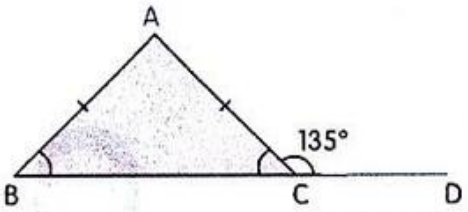
Finding Unknown Angles

Before you learn ...

ABCD is a parallelogram. BECD is a rhombus. ABE is a straight line. $\angle BEC = 40°$. Find $\angle CBE$ and $\angle CDA$. Explain how you obtained your answers.



LEARN 1 ABC is an isosceles triangle. AB = AC. BCD is a straight line. Find $\angle ACB$ and $\angle ABC$.

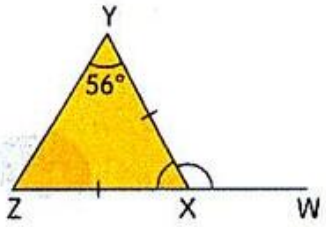


We use angles on a straight line property to find $\angle ACB$.
Given that Triangle ABC is an isosceles triangle, $\angle ACB = \angle ABC$.

$\angle ACB = 180° - 135°$
$= 45°$

$\angle ABC = \angle ACB$
$= 45°$

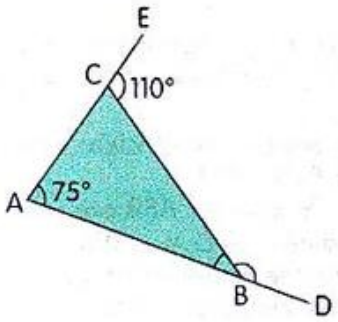
TRY 1 ZXW is a straight line. XYZ is an isosceles triangle. XY = XZ. Find $\angle YXZ$ and $\angle YXW$.



$\angle XZY = \angle$ [ ]
$=$ [ ]°
$\angle YXZ =$ [ ]° − [ ]° − [ ]°
$=$ [ ]°
$\angle YXW =$ [ ]° − [ ]°
$=$ [ ]°

LEARN

ABC is a triangle. ABD and ACE are straight lines. Find $\angle ABC$ and $\angle CBD$.



We use angles on a straight line property to find $\angle ACB$.
Knowing that the angles in a triangle add up to 180°, we can find $\angle ABC$.
Using $\angle ABC$ and the angles on a straight line property, we can then solve for $\angle CBD$.

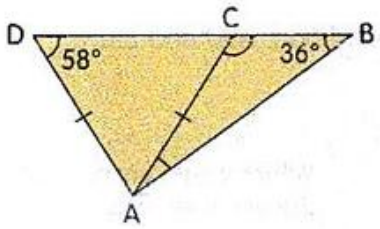
$\angle ACB = 180° - 110°$
$= 70°$

$\angle ABC = 180° - 70° - 75°$
$= 35°$

$\angle CBD = 180° - 35°$
$= 145°$

TRY 2

BCD is a straight line. ACD is an isosceles triangle. AC = AD. Find $\angle ACB$ and $\angle CAB$.



$\angle ACD =$ ____°

$\angle ACB =$ ____° − ____°

$=$ ____°

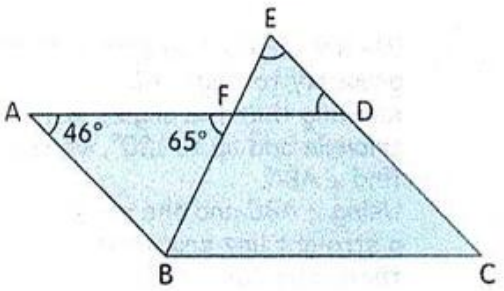
$\angle CAB =$ ____° − ____° − ____°

$=$ ____°

Which angle properties did you use? Explain.

LEARN 3

ABCD is a parallelogram. BFE and CDE are straight lines. Find ∠EDF and ∠BEC.



Knowing that the pair of angles between lines AB and DC add up to 180°, we can find ∠ADC.
We use the angles on a straight line property to find ∠EDF.
Given that ∠EFD and ∠AFB are vertically opposite angles, ∠EFD = ∠AFB.
Knowing that the angles in a triangle add up to 180°, we can find ∠BEC.

$\angle ADC = 180° - 46°$
$= 134°$

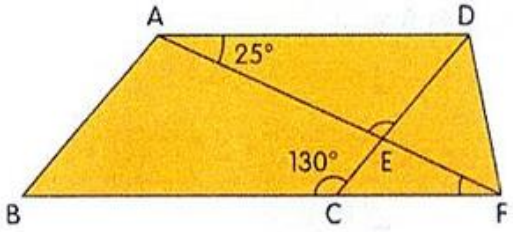
$\angle EDF = 180° - 134°$
$= 46°$

$\angle EFD = \angle AFB$
$= 65°$

$\angle BEC = 180° - 46° - 65°$
$= 69°$

TRY 3

ABCD is a parallelogram. AEF and BCF are straight lines. Find ∠AED and ∠CFE.



Which angle properties did you use? Explain.

$\angle ADC =$ ____° − ____° = ____°

$\angle AED =$ ____° − ____° − ____° = ____°

$\angle CEF = \angle$ ____ = ____°

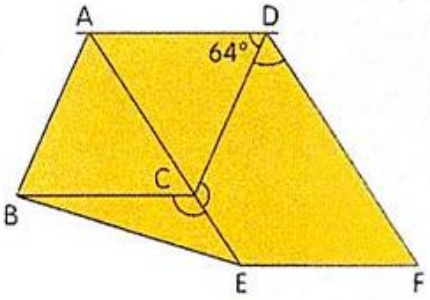
$\angle ECF =$ ____° − ____° = ____°

$\angle CFE =$ ____° − ____° − ____° = ____°

Workbook A: Practice 1, pages 161–166

Chapter 6 Review

1. ABCD is a rhombus. AEFD is a parallelogram. Find ∠DCE, ∠CDF and ∠ECB.

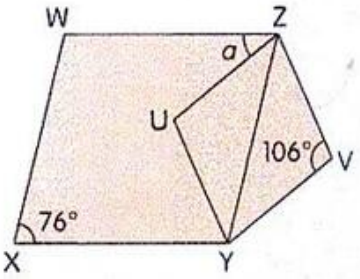


∠DCE = ____°

∠CDF = ____°

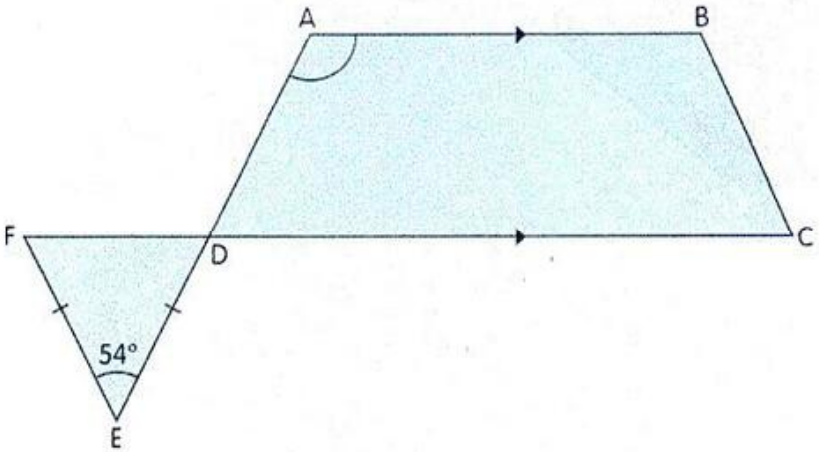
∠ECB = ____°

2. WXYZ and UYVZ are rhombuses. Find ∠a. Explain.



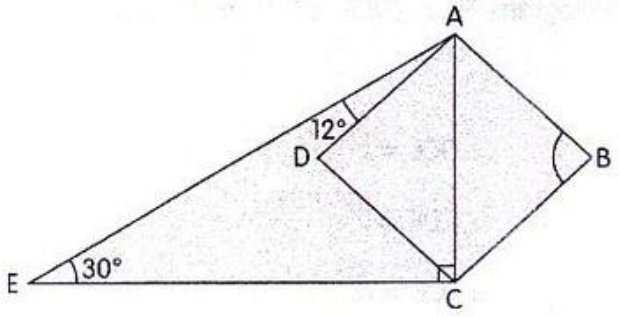
∠a = ____°

3. ABCD is a trapezium. DEF is an isosceles triangle. AB // DC.
DE = EF. ADE and CDF are straight lines. Find ∠DAB.

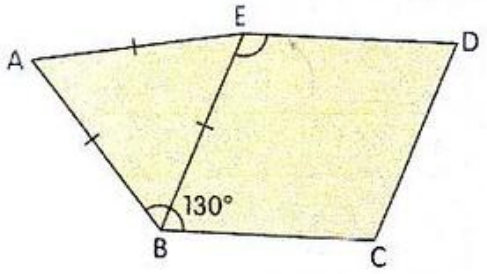


∠DAB = ____°

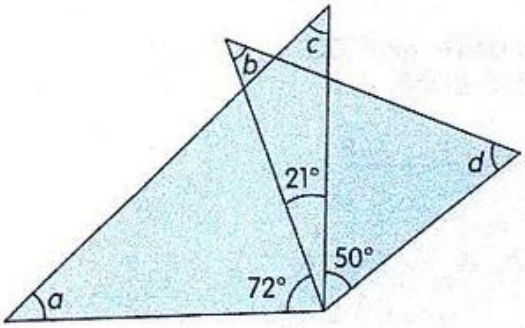
4 ABCD is a rhombus. ACE is a right-angled triangle. $\angle EAD = 12°$. $\angle AEC = 30°$. Find $\angle ABC$.



5 BCDE is a rhombus. ABE is an equilateral triangle. $\angle ABC = 130°$. Find $\angle BED$.

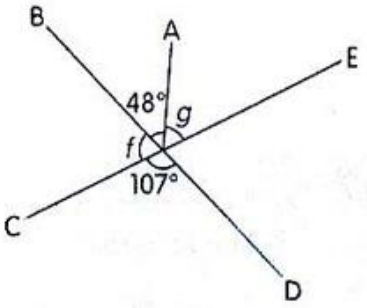


6 The figure is made up of two triangles. Find the sum of $\angle a$, $\angle b$, $\angle c$ and $\angle d$.



LOOK BACK 7 P5 Angles

BD and CE are straight lines. Find $\angle f$ and $\angle g$.

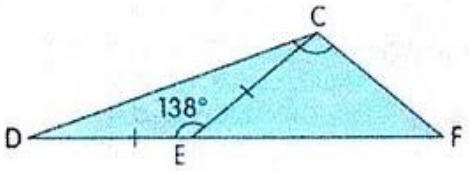


$\angle f =$

$\angle g =$

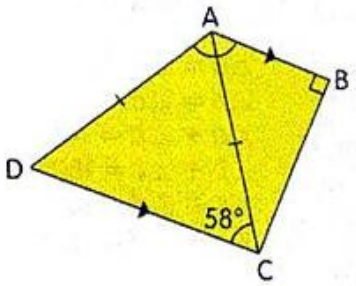
LOOK BACK 8 P5 Triangles

CDE is an isosceles triangle. DEF is a straight line. $\angle CEF = \angle CFE$. Find $\angle DCF$.



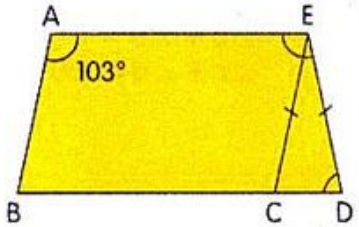
LOOK BACK 9 P5 Quadrilaterals

ADC is an isosceles triangle. AD = AC. ABC is a right-angled triangle. $\angle ACD = 58°$. AB // DC. Find $\angle DAB$.



LOOK BACK 10 P5 Quadrilaterals

ABCE is a parallelogram. CDE is an isosceles triangle. BCD is a straight line. Find $\angle CDE$ and $\angle DEA$.



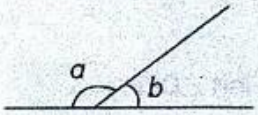
Workbook A:
Chapter 6 Review, pages 167–168
Maths Journal, page 169

Chapter Wrap-Up

Angle Properties

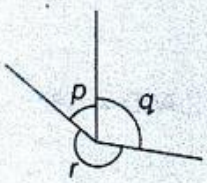
Lines

- The sum of angles on a straight line is 180°.



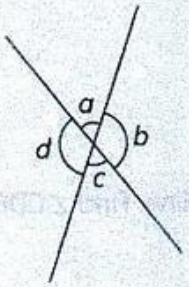
$\angle a + \angle b = 180°$

- The sum of angles at a point is 360°.



$\angle p + \angle q + \angle r = 360°$

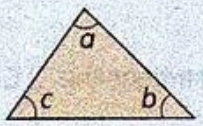
- Vertically opposite angles are equal.



$\angle a = \angle c$
$\angle b = \angle d$

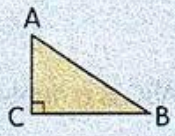
Triangles

- The sum of the angles in a triangle is 180°.



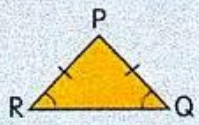
$\angle a + \angle b + \angle c = 180°$

- Right-angled triangle



$\angle CAB + \angle ABC = 90°$

- Isosceles triangle



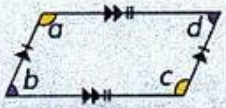
$\angle PRQ = \angle RQP$

- Equilateral triangle

$\angle x = \angle y = \angle z = 60°$

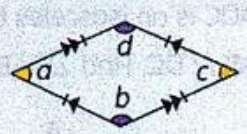
Quadrilaterals

- Parallelogram



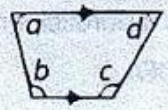
$\angle a = \angle c$
$\angle b = \angle d$
$\angle a + \angle b = 180°$
$\angle b + \angle c = 180°$
$\angle c + \angle d = 180°$
$\angle a + \angle d = 180°$

- Rhombus



$\angle a = \angle c$
$\angle b = \angle d$
$\angle a + \angle b = 180°$
$\angle b + \angle c = 180°$
$\angle c + \angle d = 180°$
$\angle a + \angle d = 180°$

- Trapezium



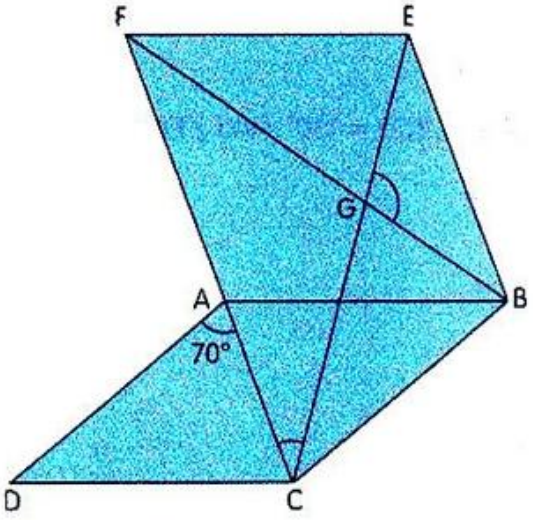
$\angle a + \angle b = 180°$
$\angle c + \angle d = 180°$

You may want to revisit the following topics:

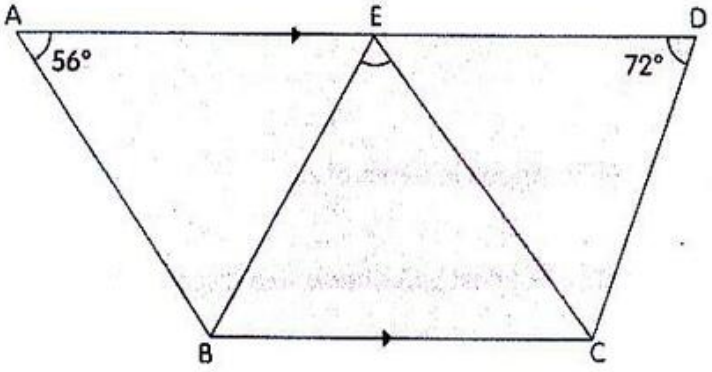
- P3 Perpendicular and Parallel Lines
- P4 Angles
- P5 Angles
- P5 Triangles
- P5 Quadrilaterals

Put On Your Thinking Cap!

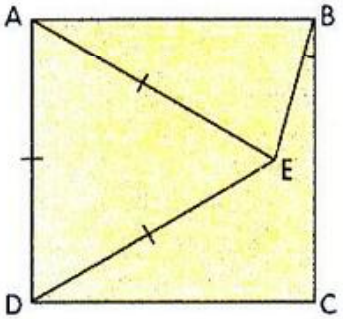
1. ABCD and ABEF are rhombuses. $\angle CAD = 70°$. CAF is a straight line. Find $\angle ECF$ and $\angle BGE$.



2. ABCDE is a trapezium. AD // BC. $\angle ABE = \angle EBC$. $\angle DCE = \angle ECB$. Find $\angle BEC$.



3. ABCD is a square. AED is an equilateral triangle. Find $\angle CBE$.

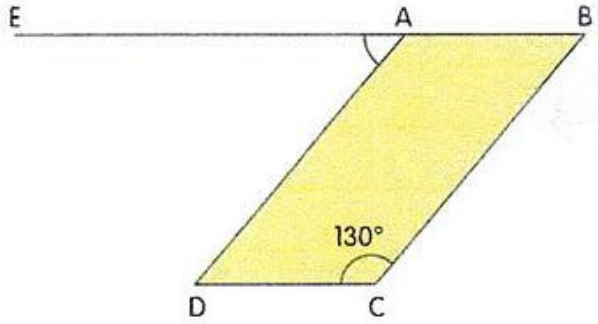


Workbook A:
Put On Your Thinking Cap!
page 170
Review 3, pages 171–178

Summative Review 1

1. Simplify $3a + 5 - 2a + 9$.

2. ABCD is a parallelogram. EAB is a straight line. $\angle BCD = 130°$. Find $\angle EAD$.



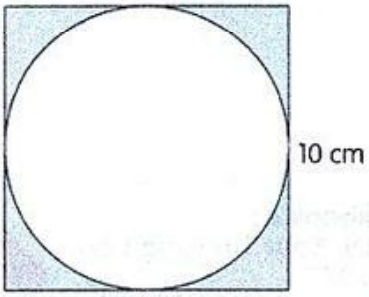
3. How many sixths are there in $\frac{2}{3}$?

4. Find the value of $\frac{2}{5} \div \frac{8}{9}$.

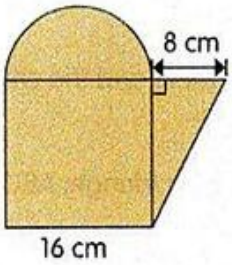
5. 3 oranges cost $\$p$. Find the cost of 47 oranges in terms of p.

6. During a sale, Nathan bought a wallet that cost \$45 after a 10% discount. What was the usual price of the wallet?

7. The figure shows a circle in a square of side 10 cm. Find the area of the shaded region. (Take $\pi = 3.14$.)



8 The figure is made up of a semicircle, a square of side 16 cm and a right-angled triangle. Find its area. Give your answer correct to 1 decimal place. (Take $\pi = 3.14$.)



9 Azwan spent $22 on a bottle of cooking oil and a carton of drinks. The cost of the bottle of cooking oil is $\frac{4}{7}$ of the cost of the carton of drinks. Find the cost of the carton of drinks.

10 Find the value of each of the following when $m = 5$.

(a) $5m + 3$

(b) $32 - 4m$

(c) $\frac{4m - 5}{3}$

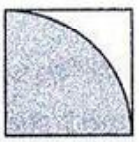
(d) $12 + \frac{m}{2}$

11 Mrs Lim baked a cake. She kept $\frac{1}{5}$ of it and divided the rest equally among her five children. What fraction of the cake did each child get?

12 The ratio of Kelsey's monthly phone bill to Mei Lin's monthly phone bill is 4 : 5. Express Mei Lin's monthly phone bill as a fraction of Kelsey's monthly phone bill.

13 Emma bought a pair of sunglasses for $65. This was after a 20% discount. What was the usual price of the pair of sunglasses?

14 Find the perimeter of the quarter circle. (Take $\pi = \frac{22}{7}$.)



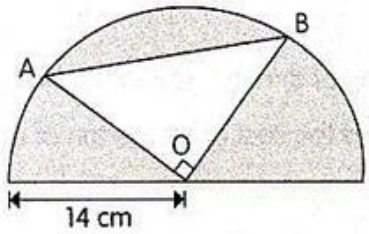
15 The sum of 4 numbers is x. If each number is increased by 55, what is the new sum of the 4 numbers?

16 The height of a chair is k cm. The height of a table is 15 cm higher than the height of the chair.

a Find the total height of the table and the chair in terms of k.

b The height of the chair is 28 cm. Find the total height of the table and the chair.

17 The figure is made up of a semicircle with centre O and a right-angled triangle ABO. Find the shaded area. (Take $\pi = \frac{22}{7}$.)



18 Darryl collected some toy cars and toy trucks. The toy cars made up 80% of his collection. $\frac{1}{5}$ of his toy cars and $\frac{1}{4}$ of his toy trucks were blue. What percentage of his collection of toy cars and toy trucks were blue?

19 The table shows the prices of some fruits at a fruit stall.

Fruit	Apples	Kiwis	Grapes	Watermelons	Peaches
Price	\$1.50 per 100 g	\$5 per $\frac{1}{2}$ kg	\$3.95 per 500 g	\$2 per kg	\$4.45 for 2

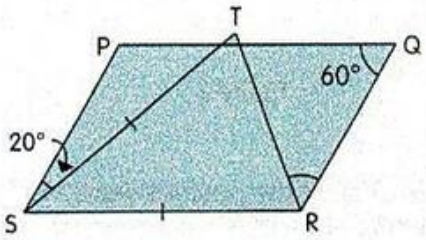
Mr Saiful bought $\frac{1}{2}$ kg of apples, $2\frac{1}{2}$ kg of kiwis, 1 kg of grapes, 600 g of watermelon and 8 peaches. After paying for the fruits, how much would Mr Saiful have left if he had \$100 at first?

20 Mr Tan had some red T-shirts and white T-shirts for sale. He sold an equal number of red T-shirts and white T-shirts. Mr Tan then had $\frac{2}{5}$ of the red T-shirts and $\frac{2}{7}$ of the white T-shirts left. What fraction of all the T-shirts did Mr Tan sell?

21 Baskets A and B contained some mangoes in the ratio 4 : 3. In Basket A, the ratio of the number of ripe mangoes to the number of unripe mangoes was 9 : 7. All the mangoes in Basket B were unripe. What fraction of all the mangoes in both baskets were unripe?

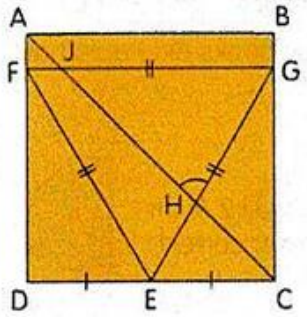
22 Kelly bought a box of 20 apples and a box of 30 pears. He found that 20% of the apples and 10% of the pears were rotten. What percentage of the fruits were not rotten?

23 PQRS is a parallelogram. TRS is an isosceles triangle.
$\angle PQR = 60°$. Find $\angle QRT$.



24 The ratio of the number of cars to the number of motorcycles at a carpark was 2 : 5. When 22 more cars entered the carpark and 22 motorcycles left the carpark, the ratio became 3 : 2. How many cars were there at the carpark at first?

25 ABCD is a square. EFG is an equilateral triangle. DE = EC. Find $\angle AHG$.



26 There were 72 pupils in the choir. $\frac{1}{6}$ of them were boys. When more boys joined the choir, the percentage of the number of boys increased to 40%. How many more boys joined the choir?

27 Two wheels are placed side by side as shown in Figure 1. Wheel X has a radius of 10.5 cm. Wheel Y has a radius of 21 cm. Both wheels are then pushed away from each other, making 10 complete turns each before coming to a stop as shown in Figure 2. What is the distance between the centres of the two wheels in the end, correct to the nearest metre?

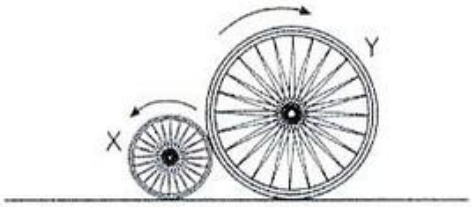


Figure 1

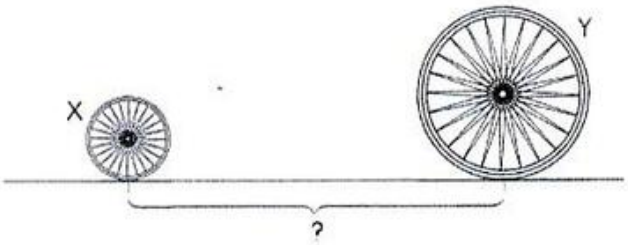


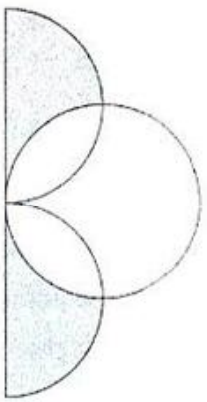
Figure 2

28 A baker made some muffins and brownies for sale. 45% of the pastries were muffins. After selling an equal number of muffins and brownies, 40% of the pastries left were muffins. He had 30 more brownies left than muffins. How many muffins did he sell?

29 Aaron had $\frac{5}{7}$ as much money as Remus. After Aaron spent $\frac{3}{5}$ of his money on a laptop, Remus had $2820 more than Aaron. How much money did Remus have?

30 Paula and Sanjay had a total of 840 books. After Paula donated $\frac{2}{3}$ of her books to the orphanage, they had an equal number of books. How many books did Paula have at first?

31 The figure shows a circle and two identical semicircles with radii 2.5 cm each. Find the total area of the shaded parts. Give your answer correct to 1 decimal place. (Take $\pi = 3.14$.)



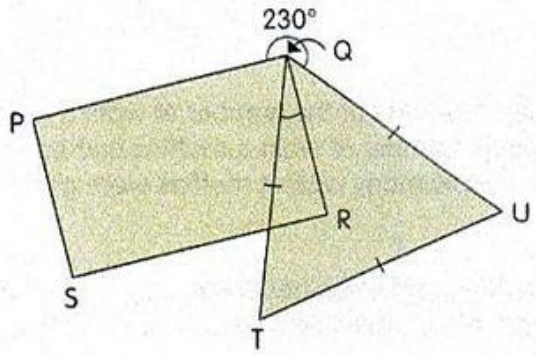
32 Jim and Leonard had a total of 99 coins. $\frac{1}{2}$ of Jim's coins were fifty-cent coins and the rest were twenty-cent coins. $\frac{3}{5}$ of Leonard's coins were fifty-cent coins and the rest were twenty-cent coins. Jim and Leonard had the same number of twenty-cent coins. How much money did they have altogether?

33 The numbers of hamsters and terrapins at a pet shop were in the ratio 23 : 20. 48 hamsters and 48 terrapins were sold. The number of terrapins then became $\frac{4}{5}$ of the number of hamsters. How many hamsters and terrapins were there altogether at first?

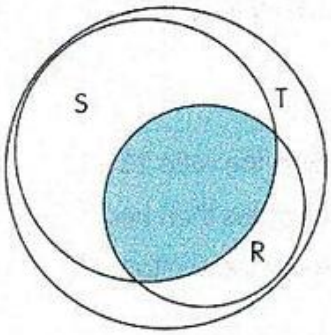
34 Mrs Ng and Mrs Ong each bought a necklace that cost $840. After Mrs Ng paid for the necklace, the ratio of the amount of money she had left to the amount of money Mrs Ong had at first was 3 : 8. After Mrs Ong paid for the necklace, the ratio of the amount of money she had left to the amount of money Mrs Ng had at first was 13 : 9. How much did each of them have at first?

35 Hwee Lin made some necklaces using coloured beads. For every 5 blue beads that she used, she used 2 red beads. She also used 4 green beads for every 15 blue beads used. She used a total of 175 coloured beads for a necklace. How many red beads did she use?

36 PQRS is a rectangle. TUQ is an equilateral triangle. Find $\angle TQR$.



37 In the figure, $\frac{2}{5}$ of Circle S is shaded. The ratio of the area of Circle R to Circle S to Circle T is 5 : 8 : 12. What is the ratio of the shaded area to the unshaded area?



38 Ken had a piece of wire d cm long. He used it to form a square and had 5 cm of wire left.

(a) What is the length of each side of the square in terms of d?

(b) If $d = 37$, what is the perimeter of the square?

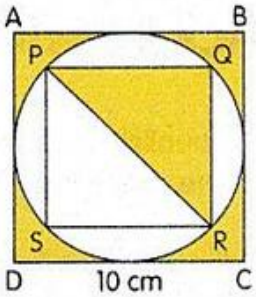
39 Some men and women attended a performance in a theatre. $\frac{1}{3}$ of the people in the theatre were men. After 25 men left the theatre, the number of men became $\frac{1}{4}$ of the total number of people in the theatre. How many women were there at the performance?

40 There were 27 walnut muffins and egg tarts. The ratio of the number of walnut muffins to the number of egg tarts was 4 : 5. An equal number of walnut muffins and egg tarts was given away and the ratio became 2 : 3. How many walnut muffins were given away?

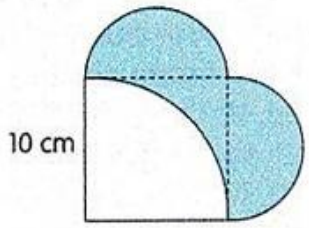
41 Sarah bought a computer at 20% discount. She paid using her credit card and received an additional 5% discount on the discounted price. Sarah paid $912 for the desktop, what was the usual price of the desktop?

42 There were 40 members in a soccer club. $\frac{3}{8}$ of them were girls. When more girls joined the soccer club, the percentage of girls increased to 75%. How many more girls joined the club?

43 The figure shows a circle in Square ABCD, and Square PQRS in the circle. The diameter of the circle is 10 cm. Find the total area of the shaded parts. (Take $\pi = 3.14$.)



44 The figure is made up of two identical semicircles and a quarter circle in a square.



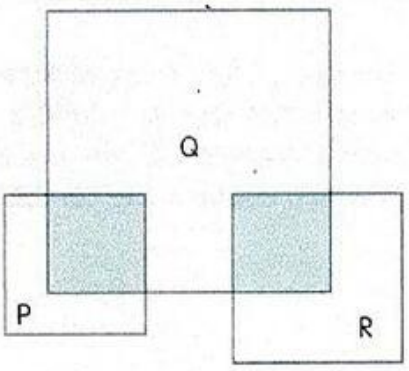
(a) Find the perimeter of the shaded part.

(b) Find the area of the shaded part.
(Take $\pi = 3.14$.)

45 Mahesh had 6 fewer \$2 notes than \$5 notes. If the total value of the notes was \$51, how many \$5 notes did Mahesh have?

46 The ratio of the number of blue cubes to the number of green cubes in a box was 1 : 3. For every 5 blue cubes taken out, 6 green cubes were taken out too. In the end, only 27 green cubes were left in the box. How many green cubes were in the box at first?

47 The figure is made up of Squares P, Q and R. The total area of Squares P and R is $\frac{5}{8}$ of the area of Square Q. $\frac{1}{2}$ of Square P is shaded, $\frac{1}{4}$ of Square Q is shaded and $\frac{1}{3}$ of Square R is shaded. What fraction of the figure is shaded?



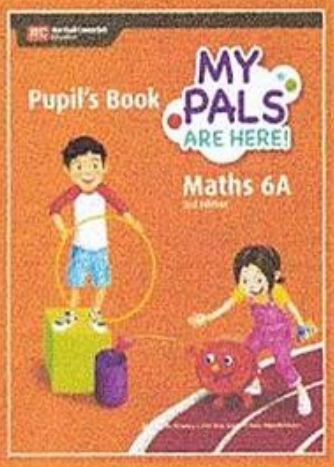
Workbook A: Revision 1, pages 179–208

Acknowledgements

The publisher would like to acknowledge the following who have kindly given permission for the use of copyright material:

Girl in pink polo tee thinking © MCE on pp. 7, 18, 41, 49, 112; girl in pink t-shirt thinking © MCE on pp. 8, 17, 26, 76, 111, 115, 125, 157; boy in grey t-shirt © MCE on pp. 8, 18, 36, 128, 166; boy in black sweater pointing and looking upwards © MCE on pp. 9, 41, 125, 166; boy in blue shirt facing sideways © MCE on pp. 11, 12, 26, 43, 47, 51, 110; girl in pink t-shirt facing sideways © MCE on pp. 11, 70, 166; girl in pink polo tee smiling © MCE on pp. 11, 13, 15, 19, 20, 34, 39, 88, 92, 140, 167, 170; boy in black sweater © MCE on pp. 11, 21, 46, 77; boy in grey t-shirt facing sideways © MCE on pp. 12, 22, 26, 47, 73, 75, 78, 96, 111, 113, 117, 157; boy in grey t-shirt thinking and looking upwards © MCE on p.13; girl in blue blouse looking upwards © MCE on pp. 13, 21, 165, 168; boy in black sweater thinking © MCE on pp. 17, 25, 35, 79, 81, 92, 94, 107, 110, 116, 132; boy in blue shirt thinking © MCE on pp. 18, 20, 82, 86, 93, 114, 122, 158, 165; girl in blue blouse smiling and looking upwards © MCE on pp. 19, 95; girl in pink polo tee looking sideways © MCE on pp. 22, 45, 72, 85, 129, 151, 165; girl in pink polo tee © MCE on pp. 23, 79, 107, 114, 146; girl in blue blouse facing sideways © MCE on pp. 35, 52, 77, 115, 138; boy in blue shirt pointing upwards © MCE on pp. 39, 167; girl in pink t-shirt © MCE on pp. 40, 44, 78, 84, 91, 168; girl in blue blouse pointing and looking sideways © MCE on pp. 43; 130, 145, 151, 170; boy in black sweater facing sideways © MCE on pp. 43, 55, 69, 114, 138, 150, 155, 167; jelly beans © Dndavis/Dreamstime.com on p. 60; boy in blue shirt © MCE on pp. 74, 91, 152, 169; boy in black sweater with hand holding chin © MCE on pp. 90, 117; girl in pink t-shirt pointing upwards © MCE on p.108; girl in blue blouse smiling © MCE on p.111; yellow plate © Furo_felix/Dreamstime.com on p. 142; bicycle wheel © Iulius Costache/ Dreamstime.com on p. 142; white lid © MCE on p. 143; wall clock © Tasosk/Dreamstime.com on p. 150; boy in grey t-shirt thinking © MCE on p.169

While every effort has been made to contact the copyright holders of material reproduced, we have been unsuccessful in some instances. To these copyright holders, we offer our sincere apologies and hope they will take our liberty in good faith. We welcome any information which would enable us to contact the copyright holders/ owners involved.



MY PALS ARE HERE! Maths (3rd Edition) is a widely adopted series in Singapore schools. It is written in line with the 2013 primary mathematics syllabus and initiatives from the Ministry of Education. Drawing from extensive research and feedback from teachers and pupils, the third edition has evolved to further strengthen mathematical concept development through the inclusion of new features to meet the needs of educators, pupils and parents.

In this edition, emphasis is given to the three clusters of mathematical processes:

Reasoning, communications and connections
- **Chapter Opener** jump-starts learning in a fun and engaging way through poems, stories and common scenarios meant to capture the pupils' interest.
- **Maths Sharing** offers opportunities for self-reflection.
- **App-tivity** offers opportunities for mastery of concepts through interactive applets.

Applications
- **Hands-On Activity** reinforces skills, concepts and problem-solving strategies through active learning.

Thinking skills and heuristics
- **Before you learn** introduces concepts through short tasks that involve concrete materials, and poses thought-provoking questions to help develop the pupils' thinking skills.
- **Learn** teaches concepts in concise steps using real-life contexts, manipulatives and meaningful visuals.
- **Put On Your Thinking Cap!** challenges pupils to solve non-routine questions.

This edition also continues to facilitate the understanding of mathematical concepts through scaffolded learning:
- **Try** allows pupils to practise new concepts with the help of the teacher.
- **Review** enables teachers to assess pupils' understanding and helps pupils to reinforce concepts learnt.
- **Chapter Wrap-Up** helps pupils consolidate concepts learnt in each chapter.

The direct correlation of the Workbook to the Pupil's Book allows for practice, assessment and development of problem-solving and thinking skills. Reviews and Revisions consolidate learning.

MY PALS ARE HERE! Maths (3rd Edition) comprises:
- Pupil's Book in 2 parts
- Workbook in 2 parts

Visit *www.mceducation.com* for more information.

ISBN 978-981-4684-01-9

Marshall Cavendish Education